# KELP FOREST MONITORING
# CHANNEL ISLANDS NATIONAL PARK

## 1990 Annual Report

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ABSTRACT

The 1990 results of the Channel Islands National Park Kelp Forest Monitoring Project are described in this report. Sixty-eight species of algae, fish, and invertebrates were monitored annually at 16 permanent sites around the five islands within the park. Survey techniques utilized SCUBA and surface-supplied-air, and included quadrats, band transects, random point contacts, size frequencies, fish and video transects, photogrammetric plots, size frequency measurements, and species list surveys. In 1990, eight sites had healthy kelp forests, while three others had remnants or signs of a developing forest, though dominated by purple sea urchins. Four sites were dominated by purple sea urchins and one was dominated by red sea urchins. Four sites had high to moderate densities of white sea urchins, but two of those had dense kelp forests over most of the transect.

## EXECUTIVE SUMMARY

As part of the long-term ecological monitoring program, Channel Islands National Park has been conducting monitoring of the kelp forests around Santa Barbara, Anacapa, Santa Cruz, Santa Rosa, and San Miguel Islands since 1982. In 1990, 44 National Park Service and volunteer divers made 759 dives during a series of seven five-day and three shorter cruises to conduct the monitoring.

Though originally all sites were kelp forests ten years ago when the monitoring program began, only eight of the 16 permanent sites had healthy kelp forests in 1990. Another site, Cathedral Cove, Anacapa Island had some kelp along the transect and showed signs of recovery though it does not really fit a description of either a kelp forest or urchin barren at present. Four other sites, including all three Santa Barbara Island sites and Scorpion Anchorage on Santa Cruz Island were considered purple sea urchin barrens, with little algae and more than 40 sea urchins per square meter. There were signs of kelp forest development nearby to Arch Point and Cat Canyon. Hare Rock on San Miguel Island had an abundance of ephemeral algae and red sea urchins. Fry's Harbor on Santa Cruz Island had an extremely high density of

small red sea cucumbers covering the site. Also on Santa Cruz Island, Pelican Bay was barren of most macro algae and was covered with silt. The purple sea urchin density has declined there in the last few years.

White sea urchin densities were high at four sites; Fry's Harbor and Yellowbanks on Santa Cruz Island, Admiral's Reef on Anacapa Island, and Southeast Sea Lion Rookery on Santa Barbara Island. Densities at Fry's Harbor were patchy and generally just below the transect area.

The water around the islands was warmer than usual in 1990. This resulted in an early deterioration of the kelp forest canopy by the end of the monitoring season. An increase in the incidence of echinoderms (sea stars, sea cucumbers, and sea urchins) with wasting disease was observed and may also be attributable to the warmer waters. At least three species of sea stars were observed with the wasting disease at seven different sites from Anacapa to Santa Rosa Island.

Fish were generally abundant with young-of-year observed for most species monitored. For many fish, 1990 appeared to be a very good recruitment year. Sheephead, kelp bass, rock wrasse, giant kelpfish, and topsmelt were some of the juvenile

fish that were noted as being especially abundant.

Red abalone abundance continued to decline slightly at most sites. Young abalone were most abundant at Hare Rock and Johnson's Lee North. The abalone at Johnson's Lee North were mostly older than one year.

In a cooperative experiment with California Department of Fish and Game, abalone recruitment modules were placed out at Yellow Banks, Gull Island, and Johnson's Lee North to test the efficacy of monitoring abalone recruitment. Juvenile hatchery raised red abalone were placed in modules to test the suitability of the modules as habitat. Juvenile native abalone were found using the modules along with various other species of fish, sea stars, octopus, and many encrusting invertebrates. After ten months, survival of transplanted abalone in the modules was best at Johnson's Lee North.

Recommendations evolving from the monitoring program in 1990 include research into improving sampling design, quantifying drift algae and siltation, and conducting regular aerial surveys of the kelp forests for quantification of kelp canopy coverage.

## INTRODUCTION

The waters of Channel Islands National Park and Channel Islands National Marine Sanctuary harbor one-third of southern California's kelp forests (Davies, 1968). The giant kelp, *Macrocystis pyrifera* is the primary constituent of these kelp forests and over 1,000 species of macro flora and fauna can be found here (Woodhouse 1981, J. M. Engle pers. comm.). Many other species, while not residents of the kelp forest community, are dependent upon the existence and productivity of the kelp forest. The kelp forest serves as food, shelter, substrate, and nursery to migratory as well as resident species. Kelp forest detrital flux provides an important source of nutrients to nearby rocky shore, sandy beach, and estuarine communities. The kelp forests are essential to our commercial and sport fisheries as well as to recreation and the associated tourist industry.

Channel Islands National Park consists of five of the eight California Channel Islands (San Miguel, Santa Rosa, Santa Cruz, Anacapa, and Santa Barbara) and the submerged lands and waters within one nautical mile of each of the islands. The Channel Islands National Marine Sanctuary overlaps the subtidal portions of the park, and its boundary extends six

miles seaward from the park islands. Channel Islands National Park also bears the designation of International Biosphere Reserve and State of California Areas of Special Biological Significance. The State of California maintains jurisdiction over the park's marine resources and manages them through the Department of Fish and Game.

The Federal Law which established Channel Islands National Park (16-USC-410) requires monitoring of the natural resources in the park. Kelp forest monitoring is part of the long-term ecological monitoring at the park designed to measure the health of the ecosystems. By determining the limits of normal variation and diagnosing abnormal conditions we hope to prescribe remedial action through management recommendations.

Following a five year design study begun in 1982, the kelp forest monitoring was implemented in 1987 by the park resource management division, using the protocol established during the design phase. Monitoring design rationale is discussed in Davis and Halvorson (1988). Preliminary results and specific design considerations can be found in reports written by Davis (1985, 1986). Richards, Gramlich, and Davis (1993), describe monitoring efforts and results for 1982-1989.

This report summarizes the monitoring efforts and results from 1990. Comparisons with previous years are discussed in general reference. The purpose of this report is to archive the data and make them available. Detailed analysis of annual variations will be provided in future reports. It is hoped that these reports will provide some insight into kelp forest dynamics and stimulate further research into the long-term trends and changes in the nearshore ecosystem. We have highlighted some of the most important observations at each of the stations, and tried to provide a characterization for each site. When possible, organisms are referred to by common name and cross referenced to their scientific names in Table 2.

## METHODS

Population dynamics of 68 taxa or "target species" (Table 2) were measured at 16 fixed sites around the five park islands (Fig. 1). Site and species selection criteria are provided in the Kelp Forest Monitoring Handbook (Davis, 1988). Sites were monitored between June and October of 1990.

Each site is marked by a 100 m-long transect permanently affixed to the seabed. The nine sampling techniques employed

to gather population dynamics information are summarized in Table 3. At each station, randomly placed 1 m x 2 m quadrats and 3 m x 20 m band transects were used to determine densities and distribution of discrete benthic organisms; 1,000 randomly selected points (RPCs) were used to determine percent cover of encrusting invertebrates, algae, and substrate composition; 2 m x 3 m x 100 m fixed transects were used to determine fish abundance; video taped transects and video taped 20 $m^2$ photogrammetric plots provide a record of the site appearance; and size frequency measurements were collected to determine age structure, population recruitment, and growth rates. A general species list was made for each station, noting presence/absence and relative abundance for all recognizable species.

White sea urchins were counted in quadrat counts at Admiral's Reef and Yellow banks in 1990 because of the high numbers of sea urchins and the difficulties of counting those densities on band transects.

In 1990 a new video system was acquired for use on video transects to document the visual changes along the length of the transect. The system is much smaller and results were favorable except for some problems with focusing. Problems

with cameras and strobes continued to plague us, so we tried videotaping the photogrids at several sites with favorable results.

Abalone recruitment modules designed by Earl Ebert of California Department of Fish and Game were placed at three sites to test the efficacy of using artificial habitat to monitor juvenile abalone recruitment. The module frames were made from plastic coated, galvanized two-inch fencing. Each frame holds twenty concrete half-blocks (cut lengthwise) and arranged in five tiers of four, forming a central open area. The cage holding the blocks protects the young abalone from fish predators, but allows young abalone and all but very large seastars to move freely in and out through the wire. Three sets of five modules were placed at each of three stations; Johnson's Lee North at Santa Rosa Island, Gull Island at Santa Cruz Island, and Yellowbanks at Santa Cruz Island. At each station, 2,000 hatchery raised abalone (from island stock) were distributed among 12 of the modules to test the suitability of the modules as habitat in October 1989. The three empty modules at each site served as controls to test the effects of pre-conditioning the modules with abalone. Further details and final results of this experiment will be presented in a later paper.

Table 1. Regularly monitored species by taxonomic grouping, common name, scientific name and associated monitoring technique.

| TAXA/COMMON NAME | SCIENTIFIC NAME | TECHNIQUE |
|---|---|---|
| ALGAE | | |
| Miscellaneous Green Algae | | R |
| Miscellaneous Red Algae | | R |
| Articulated Coralline Algae | | R |
| Crustose Coralline Algae | | R |
| Agar weed | Gelidium spp. | R |
| Sea tongue | Gigartina spp. | R |
| Miscellaneous Brown Algae | | R |
| Acid weed | Desmarestia spp. | R |
| Oar weed | Laminaria farlowii | R,Q |
| Bladder chain kelp | Cystoseira spp. | R |
| Giant kelp | Macrocystis pyrifera | R,Q |
| California sea palm | Pterygophora californica | R,Q |
| Southern sea palm | Eisenia arborea | R,Q |
| Miscellaneous plants | | R |
| INVERTEBRATES | | |
| Miscellaneous Sponges | | R |
| Orange puffball sponge | Tethya aurantia | B,S |
| Southern staghorn bryozoan | Diaperoecia californica | R |
| Miscellaneous Bryozoans | | R |
| California hydrocoral | Allopora californica | |

| | | |
|---|---|---|
| | B,S | |
| White-spotted rose anemone | | Tealia lofotensis |
| | B | |
| Red gorgonian | | Lophogorgia chilensis |
| | B,S | |
| Brown gorgonian | | Muricea fruticosa |
| | B,S | |
| California golden gorgonian | | Muricea californica |
| | B,S | |
| Strawberry anemone | | Corynactis californica |
| | R | |
| Orange cup coral | | Balanophyllia elegans |
| | R | |
| La Jolla cup coral | | Astrangia lajollaensis |
| | R | |
| Hydroids | | |
| | R | |
| Ornate tube worm | | Diopatra ornata |
| | R | |
| Colonial sand-tube worm | | Phragmatopoma californica |
| | R | |
| Chestnut cowrie | | Cypraea spadicea |
| | Q,S | |
| Wavy turban snail | | Astraea undosa |
| | Q,S | |
| Red turban snail | | Astraea gibberosa |
| | Q,S | |
| Bat star | | Patiria miniata |
| | Q,S | |
| Giant-spined sea star | | Pisaster giganteus |
| | Q,S | |
| Sunflower star | | Pycnopodia helianthoides |
| | B,S | |
| White sea urchin | | Lytechinus anamesus |
| | B,S | |
| Red sea urchin | | Strongylocentrotus franciscanus |
| | Q,S | |
| Purple sea urchin | | Strongylocentrotus purpuratus |
| | Q,S | |
| Warty sea cucumber | | Parastichopus parvimensis |
| | Q | |
| Aggregated red sea cucumber | | Pachythyone rubra |
| | R | |
| Red abalone | | Haliotis rufescens |
| | B,S | |
| Pink abalone | | Haliotis corrugata |
| | B,S | |
| Green abalone | | Haliotis fulgens |

B,S

Table 1 continued.

| TAXA/COMMON NAME | SCIENTIFIC NAME | TECHNIQUE |
|---|---|---|
| Kellet's whelk | Kelletia kelletii | B,S |
| Giant keyhole limpet | Megathura crenulata | B,S |
| California brown sea hare | Aplysia californica | B |
| Scaled tube shell | Serpulorbis squamigerus | R |
| Rock scallop | Hinnites giganteus | B,S |
| California spiny lobster | Panulirus interruptus | B |
| Tunicates | | R |
| Stalked tunicate | Styela montereyensis | Q |
| Miscellaneous Invertebrates | | R |
| SUBSTRATE | | |
| Bare Substrate | | R |
| Substrates: Rock | | R |
| Cobble | | R |
| Sand | | R |
| FISH | | |
| Bluebanded goby | Lythrypnus dalli | Q |
| Blackeye goby | Coryphopterus nicholsii | Q |
| Island kelpfish | Alloclinus holderi | Q |
| Blacksmith | Chromis punctipinnis | V |
| Señorita | Oxyjulis californica | V |
| Blue rockfish | Sebastes mystinus | |

| | | |
|---|---|---|
| | | V |
| Olive rockfish | *Sebastes serranoides* | |
| | | V |
| Kelp rockfish | *Sebastes atrovirens* | |
| | | V |
| Kelp bass | *Paralabrax clathratus* | |
| | | V |
| Sheephead | *Semicossiphus pulcher* | |
| | | V |
| Black surfperch | *Embiotoca jacksoni* | |
| | | V |
| Striped surfperch | *Embiotoca lateralis* | |
| | | V |
| Pile perch | *Damalichthys vacca* | |
| | | V |
| Garibaldi | *Hypsypops rubicundus* | |
| | | V |
| Opaleye | *Girella nigricans* | V |

B= Band Transect
Q= Quadrat Count
R= Random Point Contact
S= Size Frequency Measurement
V= Visual Transect

Table 2. Station information.

| STATION NUMBER | ISLAND | LOCATION | ABBREVIATION | DEPTH (FEET) | YEAR EST. |
|---|---|---|---|---|---|
| 1 | San Miguel | Wyckoff Ledge | SMIWL | 43-49 | 1981 |
| 2 | San Miguel | Hare Rock | SMIHR | 20-30 | 1981 |
| 3 | Santa Rosa | Johnson's Lee North | SRIJLNO | 31-36 | 1981 |
| 4 | Santa Rosa | Johnson's Lee South | SRIJLSO | 46-52 | 1981 |
| 5 | Santa Rosa | Rodes Reef | SRIRR | 43-49 | 1983 |
| 6 | Santa Cruz | Gull Island South | SCIGI | 45-54 | 1981 |
| 7 | Santa Cruz | Fry's Harbor | SCIFH | 39-42 | 1981 |
| 8 | Santa Cruz | Pelican Bay | SCIPB | 21-27 | 1981 |
| 9 | Santa Cruz | Scorpion Anchorage | SCISA | 15-20 | 1981 |
| 10 | Santa Cruz | Yellowbanks | SCIYB | 48-51 | 1986 |
| 11 | Anacapa | Admiral's Reef | ANIAR | 42-49 | 1981 |
| 12 | Anacapa | Cathedral Cove | ANICC | 20-35 | 1981 |
| 13 | Anacapa | Landing Cove | ANILC | 15-40 | 1981 |
| 14 | Santa Barbara | SE Sea Lion Rookery | SBISESL | | |

| | | | | |
|---|---|---|---|---|
| 40-46 | 1981 | | | |
| 15 | Santa Barbara | Arch Point | | SBIAP |
| 22-27 | 1981 | | | |
| 16 | Santa Barbara | Cat Canyon | | SBICC |
| 22-30 | 1986 | | | |

Table 3. Summary of sampling techniques used to monitor population dynamics of selected kelp forest organisms.

| TECHNIQUE | SAMPLE SIZE | NUMBER OF REPLICATES |
|---|---|---|
| Quadrat count | 1 m X 2 m | 20 / site |
| Band Transect count | 3 m X 20 m | 12 / site |
| Random Point count | 40 points (0.5 x 3 m) | 25 / site |
| Visual Fish transect | 2(w) X 3(h) X 100(l) m 5 minutes | 8 / site |
| Video transects | 5 minutes/100 m | 4 / site |
| Size frequency | 30 to 100 / species | 1 / site |
| Photogrammetric plots | 20 $m^2$ (80-0.5 x 0.5 m) | 1 / site |
| Species checklist | 30 - 90 minutes | 1 / site |

## STATION RESULTS AND DISCUSSION

Sampling was completed at all 16 monitoring sites by 44 divers during seven five-day cruises and three one-day cruises (Table 5). A total of 759 dives were completed for a total bottom time of 521 hours.

Following are summaries of the 1990 monitoring site status and important observations made at each site. Summary tables for quadrats, band transects, random point contact quadrats (RPCs), fish transects, and size frequencies for all 16 stations can be found in Appendix A. Species lists for the 16 stations are in Appendix B.

**Station: Wyckoff Ledge, San Miguel Island**

**Site #1 SMIWL**

1990 sampling dates: 7/24, 9/25

1990 status: Dense mature kelp forest.

The kelp at Wyckoff ledge was abundant and healthy in 1990. There was no sign of the damage done by kelp curler amphipods observed in 1989. Mean holdfast width (24 cm) did not change appreciably from the 1989 mean. This holdfast width and stipe

number (11/plant) are indicative of a mature kelp forest. Foliose red algae were abundant and diverse with over 70% coverage of the bottom, the most for any station. Acid weed was present (9% cover), but not as abundant as it was in 1988 when its peak density of 73% was recorded. The relatively low coverage (17%) of giant kelp, southern sea palm, and California sea palm was a reflection of the low abundance of the understory kelps seen in the quadrat counts. Forty-two species of algae were noted on the species list searches.

Both red and purple sea urchins were present at low densities. Wyckoff ledge was one of the few sites where red sea urchins were more numerous than purple sea urchins. Size frequencies for red sea urchins in 1989 and 1990 showed little change in mean size (59 mm) or range, and both years showed a distinct bimodality. In 1990, white sea urchins were recorded (band transects) for the first time. The densities of white sea urchins were very low.

Red abalone density was recorded at its lowest level since monitoring began ($0.028/m^2$). This density decrease; however, may simply be an artifact of random sampling and patchiness. The smallest abalone measured was 82 mm. Most of the abalone observed were hidden in crevices.

At Wyckoff Ledge, red turban snails appear to completely replace wavy turban snails which are common around the eastern islands. The ornate tube worm, was an important species occupying over 10% of the substrate. This may be related to Wyckoff Ledge being one of the sandiest sites, with over 20% sand. Another worm, Pista elongata was one of the most abundant miscellaneous invertebrates on RPC's.

Sunflower star density declined somewhat in 1990. Sizes from 8 to 260 mm were found. Giant-spined sea star density increased slightly to the highest level since monitoring began. The mean size was a relatively small 64 mm. Bat star density declined in the mid-1980's, though not as dramatically as at some of the southern stations. Density has increased since, though the 1990 density was still less than that of 1982.

Rock crabs (Cancer antennarius) were abundant at the site. Several crabs were observed feeding on a large red abalone. The kelp crab (Pugettia producta) was also abundant.

Kelpfish (Gibbonsia sp.) and tubesnouts (Aulorhynchus flavidus) were both abundant at the site. Sheephead and

rockfish seemed abundant during general observation, though were only moderately abundant on transect counts. Juvenile rockfish of several species were present in moderate to abundant densities.

**Station: Hare Rock, San Miguel Island**

**Site #2 SMIHR**

1990 sampling dates: 7/23, 7/25, 9/25

1990 status: red sea urchin barren with ephemeral algae and high density of strawberry anemones.

Only one small kelp plant grew on the transect, however there were some dense patches of algae (Ulva, Polysiphonia, sea tongue, and acid weed). Green algae was one of the most abundant organisms on RPCs. Only 10% of the substrate was considered bare compared to 23% in 1989. Seventeen species of algae were noted on the species list, mostly ephemeral, weedy species.

No sea hares, grazers of ephemeral algae, appeared on the band transects. Juvenile sea hares were observed during searches. Strawberry anemones were very abundant covering nearly 17% of the substrate. Orange and La Jolla cup corals were common.

Chestnut cowries were extremely abundant at the east end of the line, although the quadrat counts were not particularly high.

Red sea urchin density ($9/m^2$) was the highest of all the monitored sites and even higher than purple sea urchin density ($2.5/m^2$) for this site. The largest red sea urchin collected for size frequencies was 87 mm in test diameter; the mean was 58 mm.

Red abalone were not found on the band transects for the first time since 1983. Densities have been decreasing since 1986. Nearly all of the abalone found at the site for size frequency measurements were juveniles under 40 mm. This was one of the most positive signs of recent abalone recruitment seen in 1990.

Bat stars were common ($1.4/m^2$) and showed a bimodal size distribution in both 1989 and 1990. The giant-spined sea star population ($0.68/m^2$) is second only to Johnson's Lee North in density, and appears to be composed of young (small) size classes. Both large and small sunflower stars were found in moderate density ($.0278/m^2$).

Numerous large rockfish were observed at the site. Juvenile rockfish of several species were abundant. Señorita wrasses were present for the first time in several years, including young-of-year. Blue rockfish juveniles were present in moderate numbers. Kelp rockfish were abundant.

**Station: Johnson's Lee North, Santa Rosa Island**

**Site #3 SRIJLNO**

1990 sampling dates: 8/7, 8/8, 9/13

1990 status: dense maturing kelp forest with few sea urchins.

In 1990, Johnson's Lee North had a very dense kelp forest (greatest recorded density for all monitoring sites) with a surprising amount of understory algae despite a thick upper canopy. Data suggests a general maturation of the kelp forest. The number of giant kelp plants declined from 1989 densities, to about $2/m^2$, a process expected as the community matures and the forest opens. This was primarily because of a decline in juvenile plants from $8/m^2$ to $1/m^2$. Mean holdfast width increased from 22 cm in 1989 to 36 cm in 1990, while the mean number of stipes per kelp plant did not change. The percent cover of giant kelp, California sea palm, and southern

sea palm dropped from a mean of 61% in 1989, to 42% in 1990. California sea palm was the most numerous understory kelp. The opening of the canopy allowed increases in red algae, miscellaneous brown algae, and bladder chain kelp. Thirty-three species of algae were recorded. Articulated coralline algae were fairly common, while crustose coralline algae were covered by other organisms. Only 6% of the substrate was recorded as bare.

Many kelp holdfasts were encrusted with colonial sand-tube worms which increased in percent cover from zero in 1988 to 14% cover in 1990. Colonial sand-tube worm density peaked previously in 1985 when kelp was scarce. Bryozoans and hydroids were common encrusting invertebrates in 1990. Hydroids (Aglaophenia latirostris and Plumularia sp.) were the most common miscellaneous invertebrates (RPC's). Small sea cucumbers, (Pachythyone rubra and Cucumaria sp.) which were very abundant during the sea urchin-barren years, were absent from the site.

Both purple and red sea urchins were primarily restricted to the undersides of ledges and rocks. Red sea urchin density ($0.18/m^2$) dropped to the lowest level ever recorded at this site. Both species tended to be clumped; however, the highest

quadrat count for purple sea urchins was only 8 (compared to 78 in 1982 and 153 in 1984) and the variability in density was the lowest since monitoring began in 1982. The presence of few individuals in small size classes seems to indicate that there was little recruitment between 1989 and 1990. The recruitment seen in 1989 in both sea urchin species may correspond with the increase in mid-sized sea urchins observed in 1990.

Red abalone were found on band transects for the first time in three years. Sub-legal red abalone (<178 mm) were fairly common, especially under the red sea urchin spine canopy. Measured shell lengths covered a broad range with several individuals found in the one to two year-old size classes. The mean size continued its downward trend in 1990 possibly indicating recent recruitment.

Abalone recruitment modules were placed at this site on September 12, 1989. Surveys were conducted throughout the year. Experimental results were most favorable here with 27% of the hatchery abalone surviving after 10 months. Native abalone were found in the modules during five 1990 surveys (in prep.). Juvenile rockfish, sea stars, octopus, and many other invertebrates were observed utilizing the modules. Sculpins

laid eggs in the modules.

The sunflower star and bat star populations both increased sharply in 1990. The density of bat stars is still only one-fifth the density at Johnson's Lee South and one-fifth the 1982 density. Many young giant-spined sea stars were noted living in the abalone recruitment modules along with medium-sized sunflower stars. Size frequencies for sunflower stars indicate a fairly young population, but cover a broad range.

Young-of-year surfperch (kelp, pile, striped, and black) and rockfish (kelp, olive, and blue) were present. Kelp rockfish abundance remained steady after increasing along with kelp density in the previous few years. Kelp bass abundance increased slightly after decreasing during previous years.

Kelp isopods (Idotea resecata) were abundant despite a high abundance of kelp surfperch and giant kelpfish which would be expected to prey heavily on these isopods.

**Station: Johnson's Lee South, Santa Rosa Island**

**Site #4 SRIJLSO**

1990 sampling dates: 8/7, 8/8, 9/13

1990 status: dense mature kelp forest.

This site had a healthy kelp forest that was much more open than that of Johnson's Lee North. Kelp densities have not changed since 1989; however, the percent cover of understory kelps, such as juvenile giant kelp, southern sea palm and California sea palm decreased from 60% in 1989, to 17%. This site had the greatest density of California sea palm (0.53/$m^2$) for all sites in 1990 even though the density was one-fifth the 1989 density. The percent cover of kelp for this site was nearly equal to Wyckoff Ledge, San Miguel Island. The kelp population was mostly comprised of large plants with a mean holdfast width of 43 cm and a mean of 14 stipes per plant.

Ornate tube worms were abundant in sandy patches. Bryozoans and hydroids were also abundant. Hydroids, Aglaophenia sp., and small sea cucumbers, Cucumaria sp., were the most common miscellaneous invertebrates (RPCs). Colonial sand-tube worms which were so common at Johnson's Lee North, were absent here. The stalked tunicate was common at both Johnson's Lee sites.

Red gorgonians were common (0.2/$m^2$), though density was half that of 1986 when recruitment was very high. This site experiences high currents as do the other stations with high

gorgonian densities (SCIYB, ANIAR, SBISESL).

The trend for red sea urchin density ($1/m^2$) has been a slow decline since the peak of $9/m^2$ in 1986. Purple sea urchin densities have increased over the last two years from a low in 1988 to $11/m^2$ in 1990.

Red abalone densities have declined greatly since 1986 and are reaching the limits of detectability on band transects. Kellet's whelk and giant-key-hole limpet densities also seem to be declining.

This site had the greatest mean density of bat stars ($2.6/m^2$) of all the monitoring sites. Sunflower star density doubled between 1989 and 1990 to $0.26/m^2$. Nearly half of the individuals measured were relatively small (less than 100 mm radius). Giant-spined sea star densities remained low, and most of the measured population was small (<70 mm).

**Station: Rodes Reef, Santa Rosa Island**

**Site #5 SRIRR**

1990 sampling dates: 7/9, 7/10, 9/24

1990 status: mature kelp forest with dense canopy.

In general, the kelp canopy at Rodes Reef was very dense; however, many kelp plants on the eastern half of the site had been cut off at about two feet from the substrate as a result of storm damage or possibly being cut by urchin divers attempting to prevent entanglement with their air hoses. This disturbance to the kelp canopy was partially responsible for the much reduced kelp densities recorded in 1990 (0.15 /$m^2$ and 6% cover) when compared with 1989 and 1988 (1.0/$m^2$, 21% and 1.9/$m^2$, 34% respectively).

Juvenile giant kelp density was higher in 1990 (2.2/$m^2$) compared with 1989 (0.7/$m^2$). Many of these juvenile kelps showed a very strong growth between subsequent visits to this site in 1990. Size frequency modes reflect the abundance of juvenile kelp.

Under the kelp canopy it was dark with very little understory algae. Understory brown algae was rare or absent. In the cleared area, red foliose algae were more common. The red algae matured to reproductive age between visits. Overall cover of miscellaneous red algae and crustose coralline algae declined from last year; however, articulated coralline algae increased in percent cover. Acid weed, an annual species with

a peak percent cover (54%) in 1988, continued its decline in abundance to only 0.1% in 1990.

Cover of southern staghorn bryozoans increased from lows of less than 1% for the last four years to 6% in 1990 giving Rodes Reef nearly the highest percent cover for this bryozoan, second only to Anacapa's Landing Cove.

The sponges Leucosolenia eleanor and Leucetta losangelensis were common. The orange puffball sponge density increased in 1990, maintaining Rodes Reef's record for having the highest density of this species for all sites monitored.

Large Tealia columbiana were common here, one of the few places we typically see these large anemones. The snails Mitra idae were abundant in July when they were observed laying eggs.

Red sea urchin density increased from $4/m^2$ in 1989 to $7/m^2$ in 1990. Purple sea urchin density declined in from $3.2/m^2$ in 1989 to $1.3/m^2$ in 1990. Overall sea urchin density increased, maintaining the historical inverse correlation between sea urchin densities and kelp densities at this site (Fig. 2). Red sea urchins may have moved into the area in response to

increased drift algae from kelp. Sea urchins were not found on the east end of the transect where the kelp was gone.

Pink and red abalone remain rare at this site. Pink abalone were only observed during species list searches, red abalone were not found at all in 1990. Red turban snail, kellet's whelk, giant keyhole limpet, and rock scallop density declined in 1990.

A diverse assemblage of eight species of sea stars is typically found at this site. Sunflower star density at Rodes Reef is typically among the highest of all the monitoring sites. Sunflower star density dropped from 0.283/$m^2$ in 1989 to 0.1125/$m^2$ in 1990. There was an increase in mean radius over the last two years in this species, with few individuals less than 50 mm measured. A reduction in sunflower star density typically correlates with an increase in sea urchin density as is indicated at this site in 1990. Giant-spined sea stars were noted as abundant at this site. Bat stars and warty sea cucumbers were observed exhibiting symptoms of wasting disease.

Fish were abundant at this site. Blue Rockfish and Sheephead were more common in 1990 than in 1989. Tubesnouts were

present on the first visit, but not in September.

**Station: Gull Island, Santa Cruz Island**

**Site #6 SCIGI**

1990 sampling dates: 8/9, 9/12, 10/3

1990 status: moderately developed, patchy kelp forest.

Giant kelp and southern sea palm densities increased in 1990. These kelps cover much of the southern three quarters of the site. The northern quarter of the site was characterized by a more patchy, open distribution of kelp. Though there was fairly good coverage of kelp along the transect, most of the stipes did not reach the surface and many of the blades were in poor condition with perforations and heavy bryozoan growth. In general all large macroalgae densities and percent covers increased in 1990, suggesting a continuing recovery from the low values which occurred in 1986 through 1988. Juvenile kelp numbers increased dramatically from $0.2/m^2$ in 1989 to $2.2/m^2$ in 1990, suggesting a vigorous recruitment. The many young kelp plants on neighboring reefs may herald a strong general recovery of the kelp beds around Gull Island. Miscellaneous red algae and coralline algae coverage also increased in 1990. The percentage of bare substrate decreased significantly from

the 1988 and 1989 levels.

The strawberry anemone percent-cover declined significantly in 1990 to just 7% from the highest levels at any site last year (20%). The related La Jolla cup coral and the brown and red gorgonians also declined in density in 1990. These declines seem to be correlated with the return of algal cover.

The California hydrocoral, was found in significant numbers at this site only. The occurrence of the hydrocoral around the channel islands is very patchy.

Purple sea urchin densities remain extremely high at $40/m^2$. A reduction in these voracious grazers may correspond with the increase in algal cover; however, the high densities of sea urchins at this site are more indicative of sea urchin barren sites such as those at Santa Barbara Island and Scorpion Anchorage, Santa Cruz Island. Red sea urchin density remained steady at $2/m^2$. Red sea urchin mean test diameter (32 mm) remained consistent with previous years, though this is relatively small when compared to other sites and is similar to the test diameters observed for red sea urchins at Pelican Bay and Scorpion Anchorage. White sea urchin densities declined for the second year in a row to $0.6/m^2$.

Though pink and red abalone were found during species list surveys, abalone were not detected on band transects. Experimental recruitment modules were placed here on October 2, 1989. The results here were the most disappointing, with the fewest native abalone found at any of the three sites. Survival of the transplanted abalone was 31% based on the number of shells found; however, most of the abalone had disappeared.

Wavy turban snails remained scarce again in 1990 and have yet to show signs of recovery from the low densities that followed the demise of the kelp in 1988. Large sea hares were found at the north end of the transect where ephemeral algae were dominant.

Sunflower stars were detected on the band transects in 1990 for the first time in seven years. Relative abundance was also noted as increasing on species list surveys. Bat stars and giant-spined stars remained at moderate density levels.

Young-of-the-year kelp bass, giant kelpfish, señorita, and rockfish (olive, blue, and kelp) were observed. Abundances of blacksmith and sheephead were lower, while señoritas were more

abundant in 1990 than during the previous three years.

**Station: Fry's Harbor, Santa Cruz Island**

**Site #7 SCIFH**

1990 sampling dates: 7/11, 7/26, 9/26

1990 status: barrens dominated by small aggregated red cucumbers and white sea urchins.

Kelp and other large brown macroalgae were essentially absent at this site and have been since 1986. There were a few southern sea palms at the northern end of the transect. The percent cover of miscellaneous red algae increased steadily over the last two years from 1% in 1988 to 9% in 1990. The percent of bare substrate declined over the same time period.

Sponges were recorded at their highest percent-cover since 1985 and the La Jolla cup coral increased to 31%, the highest of all the monitoring sites. The southern staghorn bryozoan as well as other miscellaneous bryozoans declined in percent cover at this site.

Sea urchin abundance remained relatively steady with red sea urchins at 1.6/$m^2$ and purple sea urchins at 9.8/$m^2$. These sea

urchin densities were lower than those typically occurring at other barrens around the Channel Islands where purple sea urchin density is usually greater than 40/$m^2$. The white sea urchin density increased slightly, to 2.2/$m^2$, maintaining a steady increase since 1987. Most of the white sea urchins were found on sand along the deeper areas of the transect.

Abalone were not found during the standardized survey methods; however, pink abalone were found for the first time in three years during the species list survey. Densities of the wavy turban snail, giant keyhole limpet, and rock scallop declined slightly in 1990. Hermit crabs were found inhabiting many empty wavy turban snail shells.

Red gorgonians were found in moderate abundance with many large individuals recorded. The sizes covered broad ranges: 9-71 cm high and 6-117 cm wide.

Bat star density increased again in 1990 to nearly one individual per square meter. Individual sea stars were found in September with symptoms of the wasting disease.

Recorded abundance of juvenile blue rockfish was 100 times greater in 1990 than in 1989. Juvenile painted greenling were

also very common.

Aggregated red sea cucumbers, Pachythione rubra, were extremely abundant. These small cucumbers were recorded at 12% cover on RPCs, but impressions were that it was a much higher coverage. The cucumber's distribution was patchy in sandy areas and in the deeper areas near the center of the transect. Of all the monitored sites, Fry's Harbor had the highest recorded density of the larger warty sea cucumber (2.6/$m^2$).

**Station: Pelican Bay, Santa Cruz Island**

**Site #8 SCIPB**

1990 sampling dates: 7/12, 7/26, 9/26

1990 status: silty barrens.

This site remains barren of kelp and other macroalgae. During the 1982-1983 El Niño event, Pelican Bay underwent one of the more dramatic losses of kelp cover of all the monitoring sites, and to this date has shown no signs of recovery. Small filamentous green algae (miscellaneous green algae on RPC's) was found in relative abundance (14%) over much of the rock surface. San Miguel Island's Hare Rock was another relatively shallow site with abundant green algae.

Miscellaneous invertebrates at this site were primarily barnacles, which occupied a greater percent cover (31%) than at any other site. This site also showed a relatively high percent cover of the La Jolla cup coral (16%), second only to Fry's Harbor.

As in the case of Fry's Harbor, sea urchin densities were lower at Pelican Bay than would be found in the typical sea urchin barren. The red sea urchin densities were $2.7/m^2$ and purple sea urchins were found at densities of $10/m^2$. The red sea urchin size distribution showed a distinct shift toward smaller sizes in 1990 with the mean test diameter being reduced to 35 mm, nearly half that of last year. White sea urchin densities continued to decline steadily to a mean of less than 1 per 100 square meters in 1990.

A pink abalone was found on the band transects for the first time in three years, though there have usually been individual juveniles found under rocks during species list searches conducted over the years.

Though the density has been declining since 1987, the wavy turban snail density was still among the highest for all sites

at 1.5/$m^2$ in 1990. At most of the monitoring sites, wavy turban snail abundance generally increased during or shortly after the decline of the kelp. As kelp returned, wavy turban snail abundance declined.

Red gorgonians were relatively large and exhibited a very tight range for both height (21-50 cm) and width (23-48 cm). Though remaining more abundant at Pelican Bay than at any other monitoring site, blackeye gobies continued a steady three year decline in abundance to 5.1/$m^2$ in 1990. Kelp rockfish abundance declined to the point where they were absent from transects. Blacksmith were present at a lower abundance than at any other monitoring site.

We are curious as to why kelp has not shown any sign of recovery at this site because sea urchin density is much lower than that of a typical sea urchin barren. A possible reason may be the high level of siltation present at this site. The silt may prevent growth of the kelp gametophytes and young sporophytes. Pelican Bay has averaged the highest percent sand substrate (including silt) of all the monitoring sites and currently has the third highest percent sand at 21.2%. Trash was observed in the bay, apparently from the boaters in this popular anchorage.

**Station: Scorpion Anchorage, Santa Cruz Island**

**Site #9 SCISA**

1990 sampling dates: 7/26, 9/26, 10/29

1990 status: purple sea urchin barren.

This site was characterized by bare rock and encrusting coralline algae. No macroalgae were present along the transect though there was some kelp located to both the north and to the west. Kelp has been absent from this site since its demise in 1985 and 1986. Miscellaneous red algae cover was only 1.5%. Green algae (mostly small filaments) covered 2% of the substrate in 1990. Encrusting coralline algae cover remained high at 37%.

The Christmas-tree worm Spirobranchus spinosus and barnacles were the dominant encrusting invertebrates. The La Jolla cup coral percent cover declined slightly in 1990 and individuals were frequently found covered with silt. Though siltation appeared to be nearly as strong here as at Pelican Bay, sand (including silt) only accounted for 8.6% of the substrate composition. Both sites had a fine silt layer over the rocks.

Sea urchin densities at Scorpion were among the highest of all the monitoring sites. The red sea urchin was present at 1.35/$m^2$ and the purple sea urchin was present at 53/$m^2$. As is typical of shallow sites, there was no evidence of bimodality in the red sea urchin size distribution. All red sea urchins measured, with the exception of one, were found to be less than the legal harvest limit of 76 mm in diameter. The mean size of purple sea urchins was relatively small at 25 mm.

Similar to Pelican Bay, the wavy turban snail density increased simultaneous to the disappearance of the kelp in 1985. Although the population has undergone a decline, the density at 1.6 snails per square meter is relatively high (second only to Cathedral Cove, Anacapa Island).

Bat stars with symptoms of the wasting disease were noted at Scorpion Anchorage. The density of bat stars remained at a relatively low 0.025/$m^2$. While still visibly present, the giant-spined sea star density declined to zero in quadrat counts.

Fish abundance and diversity was low at this site when compared with the other monitoring sites. Blackeye goby density declined somewhat from 2/m2 in 1989 to 0.7/$m^2$ in 1990.

Blacksmith and señoritas were quite abundant at this site due to the presence of large numbers of young of the year. Sheephead were fairly rare at Scorpion Anchorage (0.1 per transect) compared with other sites, especially SCIFH and SCIPB (6.3 and 2.5 individuals per transect respectively). Sheephead are sea urchin predators and this may partly account for the differences in sea urchin densities between these sites.

Scorpion Anchorage has typically had the highest percentage of bare substrate with 1990 being no exception at 38%. In general, bare substrate percentages go up when sea urchin densities go up.

**Station: Yellowbanks, Santa Cruz Island**

**Site # 10**

1990 sampling dates: 8/10, 9/10, 9/11

1990 status: dense kelp forest, well developed understory kelp. High abundance of white sea urchins.

The kelp canopy was very full in 1990. Understory kelp such as southern sea palm, California sea palm, and oar weed were well developed. These algae continued an increasing trend in

percent cover to reach 36%, third highest of all monitoring sites. Adult and juvenile giant kelp density declined in quadrat counts. Decreasing quadrat densities coupled with increasing percent cover are an indication of maturing plants. The mean number of stipes per plant (18), was second only to Rodes Reef. Oar weed percent cover was among the highest of all sites at 8% with an increase in 1990. Bladder chain kelp percent cover, typically highest at Yellowbanks, increased to an all time high of 29%. Miscellaneous brown algae increased to a high of 12%. Articulated coralline algae were present at an all time high for this site of 18%, the second highest percent cover for all the monitoring sites in 1990.

Encrusting invertebrate percent cover increased in 1990. Colonial sand-tube worms made their first appearance on RPCs in five years at 0.1% cover. Percent cover for southern staghorn bryozoan (5%) and other bryozoans (14%) increased sharply in 1990.

Gorgonians were relatively abundant at Yellowbanks. The brown gorgonian's density was the highest recorded at any monitoring site. Ten individuals were recorded during band transect counts. The California golden gorgonian was also very common. The red gorgonian was very abundant with 84 individuals

recorded on band transects (one individual per 10 square meters).

Red sea urchin density dropped to 0.38/$m^2$ in 1990. Mean test diameter of these sea urchins decreased in 1990, with no individuals found that were greater than 100 mm in diameter. Purple sea urchin density dropped to 9.85/$m^2$. White sea urchins were still present in high densities of 20/$m^2$.

Pink abalone were present, but in typically low densities. Five individuals were found on band transects in 1990. Abalone recruitment modules were placed here on October 11, 1989. The experimental results were intermediate to those of Johnson's Lee and Gull Island, both in survival of transplants and in numbers of native recruits found.

Sea stars with symptoms of the wasting disease were observed at the end of the summer. Both bat stars and giant-spined sea stars were present in low abundance. Sunflower stars were not found at this site in 1990.

Blacksmith abundance increased dramatically at this site with the presence of large numbers of juveniles. Over the last four years counts per fish transect increased from 1.2 in

1987, to 151 in 1990. We observed similar patterns for all the Anacapa Island monitoring sites as well. Señorita abundance declined over the last four years from 36.5/$m^2$ to 4.6/$m^2$ in 1990. Kelp bass abundance declined steadily, as well, with 1.5 individuals noted per transect in 1990. Garibaldi have never been seen at this site.

**Station: Admiral's Reef, Anacapa Island**

**Site #11 ANIAR**

1990 sampling dates: 6/22, 7/13, 7/27, 8/24, 9/27

1990 status: dense kelp forest. High abundance of white sea urchins.

Admiral's reef was characterized by a well developed kelp forest with a relatively high abundance of most monitoring target species. Large macroalgae were present in densities among the highest of all sites. These densities are consistent with those of previous years. Giant kelp, southern sea palm, and California sea palm covered 15% of the transect. Juvenile kelp densities were low indicating a poor recruitment year. Size frequency data also suggest a shift in age composition of the giant kelp toward more mature plants. Kelp plants had a mean of 11.8 stipes per holdfast with

holdfast diameter of 22 cm. Oar weed and bladder chain kelp were abundant. Many kelp curler amphipods were observed in the canopy, however no major damage to the giant kelp was observed.

Bryozoan percent cover increased to 11% in 1990. Tunicate (4%) and miscellaneous invertebrate (30%) cover also increased to levels among the highest found in the monitoring program. Gorgonians were relatively abundant at Admiral's reef with respect to other sites. Mean sizes for both species of the brown gorgonian were largest here when compared with other sites.

We found red sea urchins in the second greatest density of any site (7.85/$m^2$). Purple sea urchins were also moderately abundant at 6.68/$m^2$. White sea urchins were very abundant at nearly 20/$m^2$. Most of the white sea urchins were concentrated on the eastern half of the transect

California spiny lobsters are regularly noted here on species list surveys; however, they are only rarely found on band transects. Only one lobster was found during band transects in 1990.

Red abalone were recorded on band transects for the first time (3 individuals or 0.0042/$m^2$) since 1985. Pink abalone, most abundant here of any site, declined to 0.032/$m^2$ in 1990, continuing a slow reduction in density begun in 1984 when density was recorded as 0.12/$m^2$.

Other mollusks such as the giant keyhole limpet (0.05/$m^2$, highest density for this site since 1984) and the rock scallop (0.08/$m^2$) increased slightly in abundance in 1990. Distribution of sizes for the rock scallop remain generally positively skewed suggesting a fairly steady rate of recruitment.

Bat stars were moderately abundant in 1990 (0.7/$m^2$). Many juvenile (<20 mm) bat stars were found under rocks. The giant-spined sea star was not recorded in quadrats and was uncommon around the reef.

In general, fish were abundant at this site. All target species were observed at this site during fish transects, with the exception of blue and olive rockfish, and striped surfperch. Blacksmith were abundant and were observed congregating around crevices in June, possibly spawning.

**Station: Cathedral Cove, Anacapa Island**

**Site #12  ANICC**

1990 sampling dates: 8/21, 9/14, 9/27

1990 status:  some kelp with sandy rock barrens.

Kelp was present but sparse at the southern end of the transect and along the margin of the talus slope on the western edge of the transect line.  The northern end of the transect was characterized by rocks and sand.  Quadrat data for 1990 suggest an increase in adult kelp density, though there was slightly less juvenile kelp.  Kelp size frequency measurements indicated a maturation of the kelp.  Mean holdfast diameter increased to 16.5 cm in 1990 while the stipe count remained at 7 stipes/holdfast.  Giant kelp percent cover maintained 10%, while bladder chain kelp cover increased to 2%, its highest percent cover since 1982.  Miscellaneous red and green algae together accounted for over 19% cover.

Red gorgonians were not recorded on band transects or found during species list surveys in 1990, suggesting a decline in abundance of this species.  This shallow site gets little current action favorable for gorgonian growth.

The red sea urchin density increased to 6/$m^2$ in 1990. Mean test diameter remained fairly steady at 74 mm. Purple sea urchin density declined slightly to 3.13/$m^2$, though overall the population seems stable at this site. This site had one of the largest mean test diameters for purple sea urchins at 34 mm.

The mean size of pink abalone increased from 91 mm to 140 mm between 1986 and 1990 and overall numbers found declined. Rock scallop density increased slightly to the highest level for this site (0.117/$m^2$). The mean size has remained relatively steady (71 mm in 1990). The California sea hare has been relatively abundant at this site with densities that appear to be stable over time.

Bat stars and giant-spined sea stars were not detected in quadrats in 1990. This represents a decline for bat stars. California spiny lobsters were seen at this site in moderate numbers.

Blackeye gobies declined to a three year low of 1.03/$m^2$ in 1990. Juvenile topsmelt, giant kelp fish, señoritas, and blacksmith were abundant. Blacksmith and señoritas were particularly abundant in 1990 with 183/transect and

53/transect respectively. Blue rockfish were common at 4/transect, an increase over previous years. Kelp bass were abundant at 10/transect.

**Station: Landing Cove, Anacapa Island**

**Site #13 ANILC**

1990 sampling dates: 8/20, 9/27

1990 status: kelp forest with well developed understory algae.

Giant kelp was healthy at this site, with a moderate recruitment of young plants in 1990. The giant kelp canopy was complimented by a lush understory assemblage of southern sea palm, oar weed and California sea palm with densities of these algae among the highest of all monitoring sites. All macroalgae densities show a remarkable degree of stability over time and 1990 densities were consistent with those of previous years. The percent cover for kelp at Landing Cove was by far the highest of all the monitoring sites at 52% (largely due to southern sea palm, particularly in the shallower areas). Giant kelp stipes/holdfast (7.4) and holdfast diameter (15 cm) indicate a moderately aged stand. Oar weed density was exceptionally high at this site at 2.3/$m^2$

and 30% cover. Percent cover of bladder chain kelp increased to its highest level since 1982 (5% in 1990). A high of 9% cover of green algae at this site was likely due to the observer noting the green film on rocks that is usually recorded as bare by other observers. Miscellaneous red algae, articulated coralline algae, and agar weed percent cover all increased between 1989 and 1990.

Southern staghorn bryozoan increased slightly (at 7%, the highest of all sites) while tunicate percent cover decreased slightly. The presence of stalked tunicates on quadrat counts is somewhat questionable.

Red sea urchins (1.25/$m^2$) were more abundant than purple sea urchins (0.58/$m^2$) which had one of the lowest densities for all the sites. Mean test diameter of the red sea urchins (83 mm) was the largest of any of the monitoring sites and the only site where mean diameter exceeded the legal commercial size limit (76 mm) attesting to the effectiveness of the ecological reserve. Purple sea urchins had a large mean size of 33 mm and a broad range of sizes, from 6 to 67 mm. Bimodality was visible in the 1990 red sea urchin size distribution with a dip between 30 mm and 80 mm.

Adult pink abalone were abundant in the cove (0.03/$m^2$); however, few juveniles were found. The mean size (143 mm) has changed little since 1987 when a fair number of smaller recruits were found.

The giant keyhole limpet density declined to the lowest level recorded at this site (0.03/$m^2$) following a steady decline from 0.12/$m^2$ in 1986. Mean size declined and fewer individuals were found for size frequency measurements (n = 38 in 1987, 7 in 1990). The chestnut cowrie and the wavy turban snail densities declined as well; however, the rock scallop density increased slightly to its highest level ever recorded for this site (0.78/$m^2$). This density was the highest rock scallop density of any monitoring site, possibly due to the marine reserve protection. Size frequencies tend to vary greatly from year to year, possibly because of diver bias when searching for these very cryptic bivalves.

Adult warty sea cucumber density was high (1.5/$m^2$) and several juveniles were found. Bat stars, though present at this site, were not found on quadrats for the fourth year in a row. The numbers of individuals found for size frequency determination declined over this time period suggesting a decline in an already small population (sample sizes declined from 19 to 9

since 1987). The mean radius in these small samples remained relatively constant over time (19 mm in 1990) and the small size suggests that the population is composed primarily of juveniles which tend to live under rocks. Giant-spined sea stars remained rare here with only one individual found in quadrats, and too few observed to measure for size frequency determination. Sea stars with wasting disease symptoms were observed in the area. Why there were so few sea stars at this site is a question open for hypotheses.

Blacksmith were very abundant in 1990 with a strong presence of juveniles. Black surfperch were not seen during fish transects in 1990, but have been common in the past. Juvenile fish were abundant, particularly blacksmith, giant kelpfish, señoritas, and kelp bass.

**Station: Southeast Sea Lion, Santa Barbara Island**

**Site #14 SBISESL**

1990 sampling dates: 6/19, 6/20, 8/22

1990 status: purple sea urchin barren. Moderate density of white sea urchins.

This site was mostly barren of algae; however, some giant kelp

plants were noted at the south end of the transect. Juvenile giant kelp were detected in the quadrats for the first time in four years, but remained rare. This suggests that some recruitment occurred, though survival in the presence of the grazing sea urchins may be severely limited. The percentage of bare substrate remained steady at 34% which was the second highest percentage bare for all the monitoring sites, second only to Scorpion Anchorage. The percent cover of sand increased.

Miscellaneous invertebrate percent cover doubled to 15% in 1990, dominated by the Christmas-tree worm (Spirobranchus spinosus), hydroids, and the soft coral Clavularia sp.. The purple encrusting bryozoan Lichenopora novae-zelandiae and the tunicate Botryllus sp. were also very common. The orange puffball sponge density increased to approximately one individual per ten square meters, second in density only to Rodes Reef.

Red gorgonians were found in the highest densities for all sites here (increasing to $0.21/m^2$ in 1990). The brown and California golden gorgonians were also relatively abundant at this site.

Red sea urchin density remained fairly steady at 1.3/$m^2$. Mean test diameter in 1990 (43.9 mm) was also essentially unchanged with respect to previous years' means with size frequencies exhibiting a very pronounced bimodality. Purple sea urchin density remained at the highest level of all sites, but declined over the previous two years to 77.5/$m^2$ in 1990. This reduction in density was accompanied by a reduction in mean test diameter from 18 mm in 1989 to 14.7 mm in 1990. White sea urchin mean density remained high (12.3/$m^2$), but declined over 50% since 1988. The mean radius of white sea urchins was only 14 mm.

Pink abalone were present, but rare (0.0014/$m^2$). Other mollusks such as Kellet's whelk, the giant keyhole limpet and the rock scallop were present, but also relatively rare. Of these, only the rock scallop was found on band transects (0.0042/$m^2$). The wavy turban snail was present at 0.2250/$m^2$. Its size frequency distribution shifted from positive to negative skew suggesting that a reduction in recruitment may have occurred over the last two or three years.

The California brown sea hare was most abundant at Santa Barbara Island and, of all sites, second most abundant at Southeast Sea Lion (0.069/$m^2$).

Bat stars continued an increasing trend in density, doubling to 0.2250/$m^2$ in 1990. Accompanying the increased density was an increase in mean radius occurring over the last three years. Some bat stars were observed to be feeding on the bryozoan Lichenopora. The commensal polychaete worm Ophiodromus pugettensis was found in abundance living in the ambulacral grooves of most bat stars at this site. The sunflower star has never been found in band transects at Santa Barbara Island.

Blackeye gobies increased in density from 0.88/$m^2$ last year to 1.18/$m^2$ in 1990. This may also correspond to the increase in percent sand substrate. Island kelpfish density remained steady at 0.53/$m^2$.

Bat rays, also associated with sandy bottoms, were plentiful in 1990. In general, however, fish densities and abundances were relatively low as is typical of sites lacking algal cover. Kelp bass abundance dropped to 1.5 per transect in 1990. Opaleye, though present at other Santa Barbara Island sites, have never been observed at this site. Interesting observations made at this site included a plainfin midshipmen found under a rock guarding a nest of large orange eggs with

embryos (eyespots visible and embryo length of 1 cm).

**Station: Arch Point, Santa Barbara Island**

**Site #15 SBIAP**

1990 sampling dates: 6/18, 6/19, 6/21, 8/23

1990 status: purple sea urchin barren, developing kelp forest.

This site has had high sea urchin densities and relatively low levels of large macroalgae since 1982. In 1990, the northern half of the site was generally devoid of algae, though a fair amount of giant kelp and understory algae was present at the south end of the line. The mean percent cover of kelp tripled (to 2.4%) in 1990. Giant kelp size frequency distribution showed a very strong positive skew with relatively small holdfasts and a mean of only six stipes per holdfast. This suggests a dynamic and young kelp forest structure, perhaps prevented from maturing by the large densities of sea urchins present. The only other large macroalga detected in quadrats was a single oar weed.

Purple sea urchin density was high at over 66/$m^2$. Red sea urchins, present at 1.7/$m^2$, had a mean size of only 51 mm.

The mean white sea urchin density declined in 1990 from 0.5/$m^2$ last year to 0.04/$m^2$ in 1990. Mean test diameter correspondingly increased from 13.1 mm in 1989 to 15.2 mm in 1990.

Pink abalone were rare at this site. Juvenile pink abalone were observed and fresh shells of both pink and red abalone were found. Wavy turban snail density continued a three year decline at this site to 0.725/$m^2$ in 1990. Kellet's whelks were not found at all in 1990, though their eggs were found during the species list survey. Only one rock scallop was found on band transects in 1990.

Large bat stars were rare and were absent from quadrat counts. Juvenile bat stars were common under rocks. Two large bat stars had ephemeral algae growing on their aboral sides and high numbers of the polychaete Ophiodromus pugettensis were observed in the bat stars' ambulacral grooves. Giant-spined sea stars were scattered over the entire area and were found in greater densities (0.1250/$m^2$) than in the previous year. The mean radius of 114 mm changed little since 1988, but the minimum size in 1990 grew to 52 mm.

Island kelp fish were present in the second highest density of

all the monitoring sites at 0.7/$m^2$. Blackeye gobies on the other hand were present in relatively low densities when compared to other sites (0.275/$m^2$). Blacksmith and señoritas were very abundant in 1990 (159 and 25 per fish transect respectively) due to the presence of juveniles. Garibaldi were present in the highest abundance of all the monitoring sites (8 individuals per fish transect). Garibaldi tagged in 1984 were still present. Opaleye showed a dramatic increase in abundance at this site in 1990 rising to 12.8 per transect, the highest abundance for this species of all monitoring sites.

**Station: Cat Canyon, Santa Barbara Island**

**Site #16 SBICC**

1990 sampling dates: 6/20, 6/21, 8/23

1990 status: purple sea urchin barren with small remnant kelp forest.

Generally, the largest portion of this site resembled an sea urchin barren with little algal cover. There was some kelp off the east end and a small kelp forest from 70 to 80 meters on the transect line. Percent cover of kelp at Cat Canyon was the highest of all Santa Barbara sites (3%). Giant kelp

density was 0.2/$m^2$. Giant kelp size frequency measurements suggest a maturation of the small kelp forest associated with this site (1988: 3.7 stipes/holdfast, 7.8 cm mean diameter, strong positive skew; 1990: 11.8 stipes/holdfast, 29.6 cm mean diameter, more normal distribution). Miscellaneous red algae cover climbed to 10%, while articulated coralline algae cover declined to 8% (from 63% in 1986). Crustose coralline algae covered 30% of the substrate here.

Red gorgonians, present at the other two Santa Barbara sites, were absent at Cat Canyon. This may be due to heavy surge and drifting sand encountered at this site. Encrusting animals such as the scaled tube shell and the colonial sand-castle worm were relatively abundant in comparison with other sites. Percent cover for both declined between 1989 and 1990.

Red sea urchins were present at a moderate density of 2.5/$m^2$. Red sea urchin mean test diameter was 59 mm, with a mode of 40 mm. Purple sea urchin density was a high 42.3/$m^2$ showing little change over the last few years.

Pink abalone declined slightly in abundance in 1990, but were still present at 0.0042/$m^2$ (3 individuals counted on band transects). Mean size remained fairly steady at 139 mm;

however, the number of individuals found for measuring decreased to only 15 in 1990. No juvenile abalone were found.

California brown sea hare density increased to 0.0611/$m^2$. This increase in sea hare density may be related to the increase in edible red algae noted at this site.

Bat stars were not found in quadrats. However, they have consistently been found during species list surveys as juveniles under rocks. Giant-spined sea stars were common at the steady density of 0.125/$m^2$, a value consistent with the other Santa Barbara monitoring sites.

Island kelpfish density doubled to 0.9/$m^2$ in 1990, the highest density for this species at any site. Opaleye abundance increased over the last two years from 0.1/transect in 1988 to 3.4/transect in 1990. Garibaldi remained at the remarkably consistent abundance of 3/transect over the last three years. Blacksmith abundance increased dramatically with the presence of large numbers of juveniles (78/transect in 1990). Clouds of juvenile blacksmith and señorita were observed in August. Kelp surfperch and juvenile giant kelpfish were also seen in 1990.

Table 4. Kelp forest monitoring site status 1990.

| | |
|---|---|
| San Miguel Island | |
| Wyckoff Ledge | Dense mature kelp forest with high diversity. |
| Hare Rock | Red sea urchin barren. |
| Santa Rosa Island | |
| Johnson's Lee North | Dense maturing kelp forest with few sea urchins. |
| Johnson's Lee South | Dense mature kelp forest. |
| Rodes Reef | Mature kelp forest with dense canopy. |
| Santa Cruz Island | |
| Gull Island | Moderately developed, patchy kelp forest. |
| Fry's Harbor | Barrens, dominated by small aggregated red cucumbers and white sea urchins. |
| Pelican Bay | Silty barrens. |
| Scorpion Anchorage | Purple sea urchin barren. |
| Yellowbanks | Dense kelp forest, well developed understory kelp. High abundance of white sea urchins. |
| Anacapa Island | |
| Admiral's Reef | Dense kelp forest. High abundance of white sea urchins. |
| Cathedral Cove | Sparse kelp with sandy rock barrens. |
| Landing Cove | Kelp forest, well developed understory algae. |
| Santa Barbara Island | |
| SE Sea Lion Rookery | Purple sea urchin barren. Moderate density of white sea urchins. |
| Arch Point | Purple sea urchin barren, developing kelp forest. |
| Cat Canyon | Purple sea urchin barren with a small remnant kelp forest. |

## GENERAL DISCUSSION

The water around the islands in 1990 was typically 16-20°C all summer. Wyckoff ledge was 12-13°C. This was slightly warmer than normal. In 1990, we observed an increase in the occurrence of the sea star wasting disease that was so devastating in 1984, possibly because of the warmer waters. We observed a decline in the kelp canopy by the end of the summer. The sloughing of fronds and the general poor conditions of the canopy may also be a result of warmer than normal temperatures with its attendant low nutrient concentrations.

Sunflower stars were found on band transects at only the six western-most sites. This is fairly typical for this more northern ranging sea star. A few individual sunflower stars are occasionally observed at other sites but always in low numbers. Sunflower stars are important invertebrate predators, and possibly the most important predator on sea urchins at the northern islands.

Sea stars affected by the wasting disease were observed at Rodes Reef, Santa Rosa Island; Fry's Harbor, Pelican Bay, Scorpion Anchorage, and Yellow Banks, Santa Cruz Island; and

Landing Cove, and Admiral's Reef, Anacapa Island. Bat stars, giant-spined sea stars, and comet stars Linkia columbiana were all observed to be affected by the disease. A warty sea cucumber with symptoms of wasting disease was noted at Rodes Reef. The wasting disease was first observed in our area in 1983 and 1984. The affected seastars develop white lesions that may spread over the affected star. Heavily affected individuals appear to be rotting. The cause seems to be a bacterial infection (Schroeter and Dixon 1988), but no conclusive work has been published.

Warm water conditions were noted off Santa Catalina with temperatures near those of the 1982-1984 El Niño (W. MacFarland, Catalina Island Marine Science Center, personal communication). Diseased and dying sea urchins and sea stars were observed at Santa Catalina island in 1990 (J. Engle, Tatman Foundation, personal communication).

Seven sites (SMIHR, SCIFH, SCIPB, SCISA, SBIAP, SBISESL, SBICC) were primarily barren of kelp in 1990. Four of those (SCISA, SBISESL, SBIAP, SBICC) had purple sea urchin densities greater than $40/m^2$. The purple sea urchin density at Gull Island was $40/m^2$, but kelp was abundant at the site. The highest red sea urchin density for the 16 stations was at Hare

Rock where densities were 9/$m^2$. The purple sea urchin density at Hare Rock was only 2/$m^2$.

White sea urchins were noted as abundant at Southeast Sea Lion, Admiral's Reef, and Yellow Banks. All three sites had mean densities over 10/$m^2$. At Gull Island, white sea urchins were common, though scattered and found mostly in the sand next to the transect reef.

In general there was very good fish recruitment in 1990. Juvenile señorita were seen in abundance at every island. Young-of-year sheephead, kelp bass, rock wrasse, giant kelpfish, and topsmelt were commonly seen at many sites east of Gull Island. Juvenile blacksmith were very common at all stations on Santa Cruz, Anacapa, and Santa Barbara Islands. Adult blacksmith were counted on transects at every station except Wyckoff Ledge. Juvenile garibaldi were observed only on Anacapa and Santa Barbara Islands. Young-of-year rockfish and painted greenling were observed mostly west of Pelican Bay. The abundance of rockfish juveniles decreased eastward from San Miguel. Juvenile surfperch were most abundant and diverse at Santa Rosa Island, but were also observed at Arch Point. Adult striped surfperch were not counted on transects east of Santa Rosa Island, though one was seen at Anacapa

Landing . Adult garibaldi were rare west of Fry's Harbor, and absent at San Miguel Island.

In 1990, the kelp forest monitoring and the decline in abalone populations were featured on CNN news and in the Challenge of the Seas television series on the Arts and Entertainment network. We also provided advice to a British television series filming the underwater kelp forests, and provided photos to the Star Free Press for an article on global warming.

Recommendations

We need to improve size frequency sampling to insure that our samples are representative of the larger population. To test if our methods are adequate we need to conduct some duplicate sampling and run statistical analysis. Ways to improve the present sampling may include a random starting point approach and improved training for species ID and search image for divers. Our concern stems from the occasional inability of volunteer divers to find juveniles of some species which may be present but hidden.

Towards a more complete understanding of the kelp forest

community we should examine temporal questions relating to the population dynamics and diversity of the kelp forest. Quarterly sampling at selected sites would provide insight to the seasonal changes and to the mechanisms of annual changes. Selected sampling at night, especially for sea stars and lobster, might generate some interesting information useful in understanding their habits and dynamics.

There has been recent interest in the amount of food getting to the drift algae feeders and in how the amount of drift kelp relates to the living canopy. We need to develop methods to quantify drift kelp. A probable beginning would be to collect drift kelp in the quadrats and quantify it by weight.

There may be a quick and easy way to determine the amount of silt present in the substrate at each site. A quantitative comparison of siltation at various sites might aid in explaining some of the differences in recruitment (settling) of various organisms.

It would be of extreme value to conduct regular aerial surveys of the kelp beds around the islands. Kelp forest canopy cover could then be readily entered into a permanent GIS file. This information would provide a valuable overview to the

underwater kelp forest monitoring work, suggest kelp recruitment sources, and add a valuable dimension to our record of natural resources around the islands.

Table 5. 1990 Kelp Forest Monitoring Program participant and cruise list.

| PARTICIPANTS | AFFILIATION | CRUISES PARTICIPATED |
|---|---|---|
| Dean Antonio | Moss Landing Marine Lab | 1 |
| Bill Avery | Channel Islands N.P. | 1,2,3,4,5,6,7,8,9,10 |
| Kristine Barsky | Calif. Dept. Fish & Game | 3 |
| Steve Barsky | Viking Diving Equipment | 3 |
| Randy Bidwell | Channel Islands N.P. | 9 |
| Susan Bower | Univ. of So. Calif. | 2 |
| Kent Bullard | Channel Islands N.P. | 5 |
| Don Canestro | U. C. Santa Barbara | 4 |
| Dave Compton | Catalina Isl. Marine Inst. | 6 |
| John Conti | Truth Aquatics | 2 |
| Melinda Conti | Truth Aquatics | 2 |
| Ronnie Damico | CSU Long Beach | 3 |
| Gary Davis | Channel Islands N.P. | 1,8,9,10 |
| Dennis Divins | U. C. Santa Barbara | 4 |
| Matt Edwards | U. C. Santa Barbara | 2 |
| Jack Engle | Tatman Foundation | 9 |
| Kip Evan | U. C. Santa Barbara | 5 |
| Kate Faulkner | Channel Islands N.P. | 5,8 |
| Perry Ferguson | Channel Isl. Council Div. | 9 |
| Constance Gramlich | Channel Islands N.P. | 1,2,3 |
| Pete Haaker | Calif. Dept. Fish & Game | 7,9 |
| Dan Heilprin | Moss Landing Marine Lab | 1 |
| John Heine | Moss Landing Marine Lab | 3 |
| Karl Huggins | Univ. of Michigan | 3 |
| Kelly Kiefer | Catalina Isl. Marine Inst. | 7 |
| Hans Kuck | L.A. Mus. Nat. History | 5 |
| David Kushner | Channel Islands N.P. | 2,3,4,5,6,7,8,9,10 |
| Bud Laurent | Calif. Dept. Fish & Game | 6 |
| Steve Lonhart | Catalina Mar. Sci. Center | 7 |
| Dave Meyer | Teacher | 5 |
| Mike McNulty | Moss Landing Marine Lab | 1 |
| Ron McPeak | Kelco | 7 |
| John Provo | Channel Islands N.P. | 1,2,3,4,5,6,7,10 |
| Paul Reilly | Calif. Dept. Fish & Game | 4 |
| Dan Richards | Channel Islands N.P. | 1,2,3,4,5,6,7,8,9,10 |

| | | |
|---|---|---|
| Diane Richardson | Channel Islands N.P. | 1,2,3,4,6,7,10 |
| Ken Schiff | S. Ca. Cst. Wtr. Res. Prj. | 8 |
| Mack Shaver | Channel Islands N.P. | 4,9 |
| Rob Sherlock | Catalina Isl. Marine Inst. | 6 |
| Dave Steichen | U. C. Santa Barbara | 1 |
| Dave Stoltz | Channel Islands N.P. | 5,8 |
| Jim Thompson | Santa Cruz | 6 |
| Bob Todd | Redwood N.P. | 7 |
| John Trone | City of San Francisco | 4 |

Table 5. continued.

| Cruise Dates 1990 | |
|---|---|
| CRUISE # 1 | June 18-22, 1990 |
| CRUISE # 2 | July 9-13, 1990 |
| CRUISE # 3 | July 23-27, 1990 |
| CRUISE # 4 | August 6-10, 1990 |
| CRUISE # 5 | August 20-24, 1990 |
| CRUISE # 6 | September 10-14, 1990 CRUISE # 7 September 24-28, 1990 |
| CRUISE # 8 | October 2-3, 1990 |
| CRUISE # 9 | October 4, 1990 |
| CRUISE #10 | October 25, 1990 |

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**Appendix A. 1990 Station Data - All Sampling Methods**

Introduction

Following are data gathered in 1990 for all kelp forest monitoring program sampling methods. Means, standard deviations and total number of samples (cases) are given for QUADRATS, BAND TRANSECTS, RANDOM POINT CONTACTS, and FISH TRANSECTS. SIZE FREQUENCY data are presented as percentiles falling within indicated size classes. (Readers should be aware that the number of significant digits is an artifact of the database program and does not imply this level of precision.)

Notes on methods:

QUADRATS. Means represent average counts obtained from 20 stratified random 1m X 2m quadrats, each the sum of two individual divers' counts in 1m X 1m quadrats.

BAND TRANSECTS. Means represent average counts obtained from 12 stratified random 3m X 20m transects, each the sum of two individual divers' counts on 3m X 10m quadrats.

RANDOM POINT CONTACTS. Means represent average percent cover for a given organism, or substrate, at 25 stratified random locations along the transect line. Forty points from each quadrat (1,000 points total) are used to determine percent cover of selected organisms and substrate within one meter of the bottom. Percent cover may total more than 100% because of layering.

FISH TRANSECTS. Means represent the average of counts obtained on each pass by divers swimming the entire 100m transect line and observing fishes passing within a 2m X 3m "window" centered on the line. Cases listed refer to the total number of passes made during fish surveys for the year. Adults and juveniles as well as counts for specific transect pass, date, and time are available as raw data. Horizontal sechi measurements were made on each dive. All counts were conducted between 0900 and 1500 hours.

SIZE FREQUENCY MEASUREMENTS. Cases (N) represent the number of organisms measured. Data are presented as percentiles within size classes. Specific dimensions: Tethya- diameter in mm; Hinnites- maximum shell diameter in mm; Haliotis, Cypraea, and Kelletia- maximum shell length in mm; Astraea- maximum diameter of shell at base in mm; Megathura- shell length, not including mantle, in mm; Sea stars- maximum radius in mm; Parastichopus-contracted body length in cm; Sea urchins- test diameter in mm; Macrocystis- number of stipes (counted 1 m above the substrate) and maximum holdfast-base diameters in cm. Gorgonians and Allopora- maximum width

and height in cm. Raw data will allow correlation between stipe number and holdfast diameter for individual kelp plants and between width and height for individual gorgonians.

LOCATION 1 SAN MIGUEL ISLAND - WYCKOFF LEDGE

1990 QUADRAT DATA: MEAN NUMBER PER $M^2$

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Macrocystis pyrifera adult | 0.7000 | 0.9921 | 20 |
| Eisenia arborea | 0.0000 | 0.0000 | 20 |
| Pterygophora californica | 0.0500 | 0.1539 | 20 |
| Laminaria farlowii | 0.0000 | 0.0000 | 20 |
| Macrocystis pyrifera juvenile | 0.3750 | 0.6463 | 20 |
| Macrocystis pyrifera all | 0.1250 | 0.3932 | 20 |
| Cypraea spadicea | 0.0000 | 0.0000 | 20 |
| Astraea undosa | 0.0000 | 0.0000 | 20 |
| Astraea gibberosa | 0.0750 | 0.1832 | 20 |
| Patiria miniata | 1.1500 | 1.0144 | 20 |
| Pisaster giganteus | 0.3750 | 0.5350 | 20 |
| Strongylocentrotus franciscanus | 2.5000 | 9.3598 | 20 |
| Strongylocentrotus purpuratus | 0.5000 | 1.0761 | 20 |
| Parastichopus parvimensis | 0.1500 | 0.3285 | 20 |
| Styela monteryensis | 0.0500 | 0.2236 | 20 |
| Lythrypnus dalli | 0.0000 | 0.0000 | 20 |
| Coryphopterus nicholsii | 0.1250 | 0.3932 | 20 |
| Alloclinus holderi | 0.0750 | 0.1832 | 20 |

1990 BAND TRANSECT DATA: MEAN NUMBER PER $M^2$

| | | | |
|---|---|---|---|
| Tethya aurantia | 0.0458 | 0.0513 | 12 |
| Allopora californica | 0.0000 | 0.0000 | 12 |
| Tealia lofotensis | 0.1986 | 0.1953 | 12 |
| Lophogorgia chilensis | 0.0014 | 0.0048 | 12 |
| Muricea fruticosa | 0.0000 | 0.0000 | 12 |
| Muricea californica | 0.0000 | 0.0000 | 12 |
| Panulirus interruptus | 0.0000 | 0.0000 | 12 |
| Haliotis rufescens | 0.0028 | 0.0065 | 12 |
| Haliotis corrugata | 0.0000 | 0.0000 | 12 |
| Haliotis fulgens | 0.0000 | 0.0000 | 12 |
| Kelletia kelletii | 0.0931 | 0.0524 | 12 |
| Megathura crenulata | 0.0000 | 0.0000 | 12 |
| Hinnites giganteus | 0.0000 | 0.0000 | 12 |
| Aplysia californica | 0.0000 | 0.0000 | 12 |
| Pycnopodia helianthoides | 0.0125 | 0.0161 | 12 |
| Lytechinus anamesus | 0.0042 | 0.0104 | 12 |

1990 RANDOM POINT CONTACT DATA: MEAN PERCENT COVER

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Green algae | 0.0000 | 0.0000 | 25 |
| Miscellaneous brown algae | 0.5000 | 1.2500 | 25 |
| Desmarestia spp. | 8.8000 | 13.1323 | 25 |
| Laminaria farlowii | 0.1000 | 0.5000 | 25 |
| Cystoseira spp. | 2.1000 | 5.2381 | 25 |
| Macrocystis, Eisenia, Pterygophora | 17.8000 | 19.5299 | 25 |
| Miscellaneous red algae | 71.9000 | 16.9601 | 25 |
| Articulated coralline algae | 7.9000 | 7.5581 | 25 |
| Crustose coralline algae | 13.6000 | 7.0000 | 25 |
| Gelidium spp. | 0.0000 | 0.0000 | 25 |
| Gigartina spp. | 4.2000 | 4.3732 | 25 |
| Miscellaneous plants | 0.0000 | 0.0000 | 25 |
| Sponges | 0.5000 | 1.4434 | 25 |
| Corynactis californica | 0.2000 | 0.6922 | 25 |
| Balanophyllia elegans | 1.6000 | 2.5900 | 25 |
| Astrangia lajollaensis | 0.2000 | 0.6922 | 25 |
| Diopatra ornata | 12.6000 | 11.5578 | 25 |
| Phragmatopoma californica | 0.5000 | 1.7678 | 25 |
| Serpulorbis squamigerus | 0.0000 | 0.0000 | 25 |
| Bryozoans, other | 8.5000 | 8.6903 | 25 |
| Diaperoecia californica | 0.5000 | 1.4434 | 25 |
| Tunicates | 2.4000 | 4.7588 | 25 |
| Miscellaneous invertebrates | 6.6000 | 5.5846 | 25 |
| Bare substrate | 7.5000 | 13.8067 | 25 |
| Rock | 74.3000 | 23.5576 | 25 |
| Cobble | 2.3000 | 3.4551 | 25 |
| Sand | 23.4000 | 21.7931 | 25 |

1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| | | | |
|---|---|---|---|
| TOTAL FISH ABUNDANCE | 1.0833 | 2.7015 | 96 |
| Chromis punctipinnis | 0.0000 | 0.0000 | 8 |
| Oxyjulis californica | 7.0000 | 6.1179 | 8 |
| Sebastes mystinus | 1.8750 | 2.6959 | 8 |
| Sebastes serranoides | 0.1250 | 0.3536 | 8 |
| Sebastes atrovirens | 0.8750 | 0.8345 | 8 |
| Paralabrax clathratus | 0.2500 | 0.7071 | 8 |
| Semicossyphus pulcher | 0.8750 | 1.1260 | 8 |
| Embiotoca jacksoni | 0.2500 | 0.4629 | 8 |
| Embiotoca lateralis | 1.6250 | 1.5980 | 8 |
| Damalichthys vacca | 0.1250 | 0.3536 | 8 |
| Hypsypops rubicundus | 0.0000 | 0.0000 | 8 |
| Girella nigricans | 0.0000 | 0.0000 | 8 |

1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| Species | Date (year/month/date) | Mean | Std Dev | Cases |
|---|---|---|---|---|
| Chromis punctipinnis adult | | 0.0000 | 0.0000 | 8 |
| | 900724 | 0.0000 | 0.0000 | 4 |
| | 900925 | 0.0000 | 0.0000 | 4 |
| Chromis punctipinnis juvenile | | 0.0000 | 0.0000 | 8 |
| | 900724 | 0.0000 | 0.0000 | 4 |
| | 900925 | 0.0000 | 0.0000 | 4 |
| Oxyjulis californica adult | | 5.0000 | 5.6315 | 8 |
| | 900724 | 0.7500 | 1.5000 | 4 |
| | 900925 | 9.2500 | 4.8563 | 4 |
| Oxyjulis californica juvenile | | 2.0000 | 1.8516 | 8 |
| | 900724 | 2.0000 | 1.4142 | 4 |
| | 900925 | 2.0000 | 2.4495 | 4 |
| Sebastes mystinus adult | | 1.6250 | 2.6693 | 8 |
| | 900724 | 0.7500 | 0.9574 | 4 |
| | 900925 | 2.5000 | 3.6968 | 4 |
| Sebastes mystinus juvenile | | 0.2500 | 0.7071 | 8 |
| | 900724 | 0.0000 | 0.0000 | 4 |
| | 900925 | 0.5000 | 1.0000 | 4 |
| Sebastes serranoides adult | | 0.1250 | 0.3536 | 8 |
| | 900724 | 0.0000 | 0.0000 | 4 |
| | 900925 | 0.2500 | 0.5000 | 4 |

| | | | |
|---|---|---|---|
| Sebastes serranoides juvenile | | 0.0000 | 0.0000 |
| 8 | | | |
| | 900724 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900925 | 0.0000 | 0.0000 |
| 4 | | | |
| Sebastes atrovirens adult | | 0.3750 | 0.5175 |
| 8 | | | |
| | 900724 | 0.5000 | 0.5774 |
| 4 | | | |
| | 900925 | 0.2500 | 0.5000 |
| 4 | | | |
| Sebastes atrovirens juvenile | | 0.5000 | 0.7559 |
| 8 | | | |
| | 900724 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900925 | 1.0000 | 0.8165 |
| 4 | | | |
| Paralabrax clathratus adult | | 0.0000 | 0.0000 |
| 8 | | | |
| | 900724 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900925 | 0.0000 | 0.0000 |
| 4 | | | |

| | | | | |
|---|---|---|---|---|
| Paralabrax clathratus juvenile | | 0.2500 | 0.7071 | 8 |
| | 900724 | 0.5000 | 1.0000 | 4 |
| | 900925 | 0.0000 | 0.0000 | 4 |
| Semicossyphus pulcher male | | 0.2500 | 0.4629 | 8 |
| | 900724 | 0.0000 | 0.0000 | 4 |
| | 900925 | 0.5000 | 0.5774 | 4 |
| Semicossyphus pulcher female | | 0.6250 | 1.1877 | 8 |
| | 900724 | 1.2500 | 1.5000 | 4 |
| | 900925 | 0.0000 | 0.0000 | 4 |
| Embiotoca jacksoni adult | | 0.2500 | 0.4629 | 8 |
| | 900724 | 0.0000 | 0.0000 | 4 |
| | 900925 | 0.5000 | 0.5774 | 4 |
| Embiotoca jacksoni juvenile | | 0.0000 | 0.0000 | 8 |
| | 900724 | 0.0000 | 0.0000 | 4 |
| | 900925 | 0.0000 | 0.0000 | 4 |
| Embiotoca lateralis adult | | 1.1250 | 1.3562 | 8 |
| | 900724 | 0.7500 | 0.9574 | 4 |
| | 900925 | 1.5000 | 1.7321 | 4 |
| Embiotoca lateralis juvenile | | 0.5000 | 1.4142 | 8 |
| | 900724 | 0.0000 | 0.0000 | 4 |
| | 900925 | 1.0000 | 2.0000 | 4 |
| Damalichthys vacca adult | | 0.0000 | 0.0000 | 8 |
| | 900724 | 0.0000 | 0.0000 | 4 |

| | | | |
|---|---|---|---|
| | 900925 | 0.0000 | 0.0000 |
| 4 | | | |
| Damalichthys vacca juvenile | | 0.1250 | 0.3536 |
| 8 | | | |
| | 900724 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900925 | 0.2500 | 0.5000 |
| 4 | | | |
| Hypsypops rubicundus adult | | 0.0000 | 0.0000 |
| 8 | | | |
| | 900724 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900925 | 0.0000 | 0.0000 |
| 4 | | | |
| Hypsypops rubicundus juvenile | | 0.0000 | 0.0000 |
| 8 | | | |
| | 900724 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900925 | 0.0000 | 0.0000 |
| 4 | | | |
| Girella nigricans adult | | 0.0000 | 0.0000 |
| 8 | | | |
| | 900724 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900925 | 0.0000 | 0.0000 |
| 4 | | | |
| Girella nigricans juvenile | | 0.0000 | 0.0000 |
| 8 | | | |
| | 900724 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900925 | 0.0000 | 0.0000 |
| 4 | | | |

1990 SIZE FREQUENCIES

Tethya aurantia

| | |
|---|---|
| (cases) N= | 31 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 3.2% |
| 30 - 39 | 3.2% |
| 40 - 49 | 6.5% |
| 50 - 59 | 12.9% |
| 60 - 69 | 16.1% |
| 70 - 79 | 9.7% |
| 80 - 89 | 12.9% |
| 90 - 99 | 12.9% |
| > 99 | 22.6% |
| min size (mm) | 25 |
| max size (mm) | 122 |
| mean | 78 |
| mode | 45 |

Kelletia kelletii

| | |
|---|---|
| (cases) N= | 38 |
| < 40 | 0.0 |
| 40 - 49 | 0.0 |
| 50 - 59 | 0.0 |
| 60 - 69 | 5.3% |
| 70 - 79 | 10.5% |
| 80 - 89 | 15.8% |
| 90 - 99 | 31.6% |
| 100 - 109 | 26.3% |
| 110 - 119 | 7.9% |
| 120 - 129 | 2.6% |
| 130 - 139 | 0.0 |
| 140 - 149 | 0.0 |
| > 149 | 0.0 |
| min size (mm) | 66 |
| max size (mm) | 120 |
| mean | 96 |
| mode | 96 |

Haliotis rufescens

| | |
|---|---|
| (cases) N= | 18 |
| < 25 | 0.0 |
| 25 - 29 | 0.0 |
| 30 - 34 | 0.0 |
| 35 - 39 | 0.0 |
| 40 - 44 | 0.0 |
| 45 - 49 | 0.0 |
| 50 - 54 | 0.0 |
| 55 - 59 | 0.0 |
| 60 - 64 | 0.0 |
| 65 - 69 | 0.0 |
| 70 - 74 | 0.0 |
| 75 - 79 | 0.0 |
| 80 - 84 | 5.6% |
| 85 - 90 | 0.0 |
| 90 - 94 | 5.6% |
| 95 - 99 | 0.0 |
| 100 - 104 | 0.0 |
| 105 - 109 | 0.0 |
| 110 - 114 | 5.6% |
| 115 - 119 | 0.0 |
| 120 - 124 | 0.0 |
| 125 - 129 | 5.6% |
| 130 - 134 | 5.6% |
| 135 - 139 | 11.1% |
| 140 - 144 | 0.0 |
| 145 - 149 | 0.0 |
| 150 - 154 | 0.0 |
| 155 - 159 | 11.1% |
| 160 - 164 | 5.6% |
| 165 - 169 | 0.0 |
| 170 - 174 | 16.7% |
| 175 - 179 | 0.0 |
| 180 - 184 | 0.0 |
| 185 - 189 | 5.6% |
| 190 - 194 | 5.6% |
| 195 - 199 | 0.0 |
| > 199 | 16.7% |
| min size (mm) | 80 |
| max size (mm) | 210 |
| mean | 156 |
| mode | 80 |

Astraea gibberosa

| | |
|---|---|
| (cases) N= | 25 |
| < 10 | 0.0 |
| 10 - 19 | 4.0% |
| 20 - 29 | 0.0 |
| 30 - 39 | 8.0% |
| 40 - 49 | 32.0% |
| 50 - 59 | 52.0% |
| 60 - 69 | 4.0% |
| 70 - 79 | 0.0 |
| 80 - 89 | 0.0 |
| 90 - 99 | 0.0 |
| 100 - 109 | 0.0 |
| 110 - 119 | 0.0 |
| > 119 | 0.0 |
| min size (mm) | 14 |
| max size (mm) | 61 |
| mean | 48 |
| mode | 42 |

Patiria miniata

| | |
|---|---|
| (cases) N= | 54 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 1.9% |
| 30 - 39 | 1.9% |
| 40 - 49 | 1.9% |
| 50 - 59 | 9.3% |
| 60 - 69 | 37.0% |
| 70 - 79 | 35.2% |
| 80 - 89 | 11.1% |
| 90 - 99 | 1.9% |
| > 99 | 0.0 |
| min size (mm) | 29 |
| max size (mm) | 90 |
| mean | 69 |
| mode | 63 |

Pisaster giganteus

| | |
|---|---|
| (cases) N= | 49 |
| < 20 | 0.0 |
| 20 - 39 | 2.0% |
| 40 - 59 | 49.0% |
| 60 - 79 | 34.7% |
| 80 - 99 | 6.1% |
| 100 - 119 | 6.1% |
| 120 - 139 | 0.0 |
| 140 - 159 | 2.0% |
| 160 - 179 | 0.0 |
| 180 - 199 | 0.0 |
| 200 - 219 | 0.0 |
| 220 - 239 | 0.0 |
| 240 - 259 | 0.0 |
| 260 - 279 | 0.0 |
| 280 - 299 | 0.0 |
| > 299 | 0.0 |
| min size (mm) | 36 |
| max size (mm) | 140 |
| mean | 64 |
| mode | 46 |

Pycnopodia helianthoides

| | |
|---|---|
| (cases) N= | 19 |
| < 20 | 5.3% |
| 20 - 39 | 5.3% |
| 40 - 59 | 26.3% |
| 60 - 79 | 5.3% |
| 80 - 99 | 31.6% |
| 100 - 119 | 5.3% |
| 120 - 139 | 0.0 |
| 140 - 159 | 0.0 |
| 160 - 179 | 5.3% |
| 180 - 199 | 5.3% |
| 200 - 219 | 0.0 |
| 220 - 239 | 0.0 |
| 240 - 259 | 0.0 |
| 260 - 279 | 10.5% |
| 280 - 299 | 0.0 |
| > 299 | 0.0 |
| min size (mm) | 6 |
| max size (mm) | 260 |
| mean | 97 |
| mode | 49 |

Strongylocentrotus franciscanus

| | |
|---|---|
| (cases) N= | 106 |
| < 5 | 0.0 |
| 5 - 9 | 0.0 |
| 10 - 14 | 1.9% |
| 15 - 19 | 4.7% |
| 20 - 24 | 9.4% |
| 25 - 29 | 3.8% |
| 30 - 34 | 4.7% |
| 35 - 39 | 3.8% |
| 40 - 44 | 1.9% |
| 45 - 49 | 3.8% |
| 50 - 54 | 5.7% |
| 55 - 59 | 2.8% |
| 60 - 64 | 3.8% |
| 65 - 69 | 4.7% |
| 70 - 74 | 7.5% |
| 75 - 79 | 13.2% |
| 80 - 84 | 17.0% |
| 85 - 90 | 8.5% |
| 90 - 94 | 0.0 |
| 95 - 99 | 1.9% |
| 100 - 104 | 0.9% |
| 105 - 109 | 0.0 |
| > 109 | 0.0 |
| min size (mm) | 13 |
| max size (mm) | 104 |
| mean | 59 |
| mode | 84 |

Strongylocentrotus purpuratus

| | |
|---|---|
| (cases) N= | 16 |
| < 5 | 0.0 |
| 5 - 9 | 0.0 |
| 10 - 14 | 6.3% |
| 15 - 19 | 12.5% |
| 20 - 24 | 43.8% |
| 25 - 29 | 18.8% |
| 30 - 34 | 6.3% |
| 35 - 39 | 0.0 |
| 40 - 44 | 0.0 |
| 45 - 49 | 6.3% |
| 50 - 54 | 6.3% |
| 55 - 59 | 0.0 |
| 60 - 64 | 0.0 |
| 65 - 69 | 0.0 |
| 70 - 74 | 0.0 |
| 75 - 79 | 0.0 |
| 80 - 84 | 0.0 |
| 85 - 90 | 0.0 |
| 90 - 94 | 0.0 |
| 95 - 99 | 0.0 |
| 100 - 104 | 0.0 |
| 105 - 109 | 0.0 |
| > 109 | 0.0 |
| min size (mm) | 10 |
| max size (mm) | 52 |
| mean | 26 |
| mode | 21 |

Parastichopus parvimensis

| | |
|---|---|
| (cases) N= | 30 |
| < 5 | 0.0 |
| 5 - 6 | 0.0 |
| 7 - 8 | 6.7% |
| 9 - 10 | 20.0% |
| 11 - 12 | 26.7% |
| 13 - 14 | 30.0% |
| 15 - 16 | 13.3% |
| 17 - 18 | 3.3% |
| 19 - 20 | 0.0 |
| 21 - 22 | 0.0 |
| > 22 | 0.0 |
| min size (cm) | 8 |
| max size (cm) | 18 |
| mean | 12 |
| mode | 11 |

Macrocystis pyrifera numbers of stipes.

| | |
|---|---|
| (cases) N= | 126 |
| < 3 | 0.8% |
| 3 - 5 | 15.9% |
| 6 - 8 | 25.4% |
| 9 - 11 | 19.0% |
| 12 - 14 | 17.5% |
| 15 - 17 | 5.6% |
| 18 - 20 | 4.0% |
| 21 - 23 | 7.1% |
| 24 - 26 | 2.4% |
| 27 - 29 | 1.6% |
| 30 - 32 | 0.8% |
| 33 - 35 | 0.0 |
| 36 - 38 | 0.0 |
| 39 - 41 | 0.0 |
| 42 - 44 | 0.0 |
| >44 | 0.0 |
| min number | 2 |
| max number | 32 |
| mean | 11 |
| mode | 8 |

Macrocystis pyrifera holdfast diameters.

| | |
|---|---|
| (cases) N= | 126 |
| < 6 | 0.0 |
| 6 - 11 | 2.4% |
| 12 - 17 | 16.7% |
| 18 - 23 | 27.8% |
| 24 - 29 | 23.0% |
| 30 - 35 | 17.5% |
| 36 - 41 | 7.1% |
| 42 - 47 | 1.6% |
| 48 - 53 | 2.4% |
| 54 - 59 | 0.0 |
| 60 - 65 | 1.6% |
| 66 - 71 | 0.0 |
| 72 - 77 | 0.0 |
| 78 - 83 | 0.0 |
| 84 - 89 | 0.0 |
| >89 | 0.0 |
| min width (cm) | 11 |
| max width (cm) | 64 |
| mean | 26 |
| mode | 32 |

LOCATION 2 SAN MIGUEL ISLAND - HARE ROCK

1990 QUADRAT DATA: MEAN NUMBER PER $M^2$

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Macrocystis pyrifera adult | 0.0250 | 0.1118 | 20 |
| Eisenia arborea | 0.0000 | 0.0000 | 20 |
| Pterygophora californica | 0.0000 | 0.0000 | 20 |
| Laminaria farlowii | 0.0000 | 0.0000 | 20 |
| Macrocystis pyrifera juvenile | 0.0000 | 0.0000 | 20 |
| Macrocystis pyrifera all | 0.0000 | 0.0000 | 20 |
| Cypraea spadicea | 0.2500 | 0.3441 | 20 |
| Astraea undosa | 0.0000 | 0.0000 | 20 |
| Patiria miniata | 1.4250 | 0.9770 | 20 |
| Pisaster giganteus | 0.6750 | 0.9358 | 20 |
| Strongylocentrotus franciscanus | 9.2250 | 6.7268 | 20 |
| Strongylocentrotus purpuratus | 2.4500 | 6.1321 | 20 |
| Parastichopus parvimensis | 0.2500 | 0.4730 | 20 |
| Styela monteryensis | 0.0000 | 0.0000 | 20 |
| Lythrypnus dalli | 0.0000 | 0.0000 | 20 |
| Coryphopterus nicholsii | 0.4750 | 0.6382 | 20 |
| Alloclinus holderi | 0.0000 | 0.0000 | 20 |

1990 BAND TRANSECT DATA: MEAN NUMBER PER $M^2$

| | | | |
|---|---|---|---|
| Tethya aurantia | 0.0139 | 0.0172 | 12 |
| Allopora californica | 0.0000 | 0.0000 | 12 |
| Tealia lofotensis | 0.0111 | 0.0148 | 12 |
| Lophogorgia chilensis | 0.0000 | 0.0000 | 12 |
| Muricea fruticosa | 0.0000 | 0.0000 | 12 |
| Muricea californica | 0.0000 | 0.0000 | 12 |
| Panulirus interruptus | 0.0000 | 0.0000 | 12 |
| Haliotis rufescens | 0.0000 | 0.0000 | 12 |
| Haliotis corrugata | 0.0000 | 0.0000 | 12 |
| Haliotis fulgens | 0.0000 | 0.0000 | 12 |
| Kelletia kelletii | 0.0000 | 0.0000 | 12 |
| Megathura crenulata | 0.0000 | 0.0000 | 12 |
| Hinnites giganteus | 0.0014 | 0.0048 | 12 |
| Aplysia californica | 0.0000 | 0.0000 | 12 |
| Pycnopodia helianthoides | 0.0278 | 0.0164 | 12 |
| Lytechinus anamesus | 0.0028 | 0.0096 | 12 |

LOCATION 2 SAN MIGUEL ISLAND - HARE ROCK
1990 RANDOM POINT CONTACT DATA: MEAN PERCENT COVER

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Green algae | 19.1000 | 23.2724 | 25 |
| Miscellaneous brown algae | 1.7000 | 3.4400 | 25 |
| Desmarestia spp. | 15.3000 | 26.0340 | 25 |
| Laminaria farlowii | 0.0000 | 0.0000 | 25 |
| Cystoseira spp. | 0.0000 | 0.0000 | 25 |
| Macrocystis, Eisenia, Pterygophora | 0.8000 | 3.5148 | 25 |
| Miscellaneous red algae | 18.6000 | 15.2937 | 25 |
| Articulated coralline algae | 0.1000 | 0.5000 | 25 |
| Crustose coralline algae | 40.5000 | 19.6850 | 25 |
| Gelidium spp. | 0.0000 | 0.0000 | 25 |
| Gigartina spp. | 1.0000 | 3.5355 | 25 |
| Miscellaneous plants | 10.1000 | 11.1915 | 25 |
| Sponges | 0.0000 | 0.0000 | 25 |
| Corynactis californica | 17.0000 | 17.3805 | 25 |
| Balanophyllia elegans | 3.7000 | 3.8270 | 25 |
| Astrangia lajollaensis | 3.1000 | 4.9096 | 25 |
| Diopatra ornata | 0.0000 | 0.0000 | 25 |
| Phragmatopoma californica | 0.0000 | 0.0000 | 25 |
| Serpulorbis squamigerus | 0.0000 | 0.0000 | 25 |
| Bryozoans, other | 1.6000 | 2.7839 | 25 |
| Diaperoecia californica | 0.0000 | 0.0000 | 25 |
| Tunicates | 0.1000 | 0.5000 | 25 |
| Miscellaneous invertebrates | 16.5000 | 16.2179 | 25 |
| Bare substrate | 9.9000 | 9.8816 | 25 |
| Rock | 78.2000 | 25.2747 | 25 |
| Cobble | 16.0000 | 24.2061 | 25 |
| Sand | 5.8000 | 8.7714 | 25 |

1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| | | | |
|---|---|---|---|
| TOTAL FISH ABUNDANCE | 12.9167 | 39.4142 | 144 |
| Chromis punctipinnis | 10.4167 | 18.8654 | 12 |
| Oxyjulis californica | 121.9167 | 73.7014 | 12 |
| Sebastes mystinus | 9.5000 | 8.9798 | 12 |
| Sebastes serranoides | 4.1667 | 4.3658 | 12 |
| Sebastes atrovirens | 0.6667 | 1.1547 | 12 |
| Paralabrax clathratus | 0.0000 | 0.0000 | 12 |
| Semicossyphus pulcher | 0.7500 | 0.7538 | 12 |
| Embiotoca jacksoni | 0.8333 | 1.0299 | 12 |
| Embiotoca lateralis | 4.5000 | 1.8829 | 12 |
| Damalichthys vacca | 2.2500 | 2.2613 | 12 |
| Hypsypops rubicundus | 0.0000 | 0.0000 | 12 |
| Girella nigricans | 0.0000 | 0.0000 | 12 |

LOCATION 2 SAN MIGUEL ISLAND - HARE ROCK
1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| Species | Date (year/month/day) | Mean | Std Dev | Cases |
|---|---|---|---|---|
| Chromis punctipinnis adult | | 8.7500 | 19.3020 | 12 |
| | 900725 | 1.0000 | 2.0000 | 4 |
| | 900925 | 12.6250 | 23.0709 | 8 |
| Chromis punctipinnis juvenile | | 1.6667 | 3.8925 | 12 |
| | 900725 | 0.0000 | 0.0000 | 4 |
| | 900925 | 2.5000 | 4.6291 | 8 |
| Oxyjulis californica adult | | 120.7500 | 75.1727 | 12 |
| | 900725 | 22.2500 | 10.7510 | 4 |
| | 900925 | 170.0000 | 22.6779 | 8 |
| Oxyjulis californica juvenile | | 1.1667 | 1.9924 | 12 |
| | 900725 | 3.2500 | 2.3629 | 4 |
| | 900925 | 0.1250 | 0.3536 | 8 |
| Sebastes mystinus adult | | 1.4167 | 1.6765 | 12 |
| | 900725 | 1.5000 | 3.0000 | 4 |
| | 900925 | 1.3750 | 0.7440 | 8 |
| Sebastes mystinus juvenile | | 8.0833 | 8.5116 | 12 |
| | 900725 | 12.7500 | 14.1980 | 4 |
| | 900925 | 5.7500 | 2.9641 | 8 |
| Sebastes serranoides adult | | 1.2500 | 2.0057 | 12 |
| | 900725 | 2.0000 | 3.3665 | 4 |
| | 900925 | 0.8750 | 0.9910 | 8 |

LOCATION 2 SAN MIGUEL ISLAND - HARE ROCK

| | | | | |
|---|---|---|---|---|
| Sebastes serranoides | juvenile | | 2.9167 | 2.7455 |
| 12 | | | | |
| | 900725 | | 6.0000 | 2.7080 |
| 4 | | | | |
| | 900925 | | 1.3750 | 0.7440 |
| 8 | | | | |
| Sebastes atrovirens | adult | | 0.4167 | 0.5149 |
| 12 | | | | |
| | 900725 | | 0.5000 | 0.5774 |
| 4 | | | | |
| | 900925 | | 0.3750 | 0.5175 |
| 8 | | | | |
| Sebastes atrovirens | juvenile | | 0.2500 | 0.8660 |
| 12 | | | | |
| | 900725 | | 0.7500 | 1.5000 |
| 4 | | | | |
| | 900925 | | 0.0000 | 0.0000 |
| 8 | | | | |
| Paralabrax clathratus | adult | | 0.0000 | 0.0000 |
| 12 | | | | |
| | 900725 | | 0.0000 | 0.0000 |
| 4 | | | | |
| | 900925 | | 0.0000 | 0.0000 |
| 8 | | | | |

| | | | |
|---|---|---|---|
| Paralabrax clathratus juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900725 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900925 | 0.0000 | 0.0000 |
| 8 | | | |
| Semicossyphus pulcher male | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900725 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900925 | 0.0000 | 0.0000 |
| 8 | | | |
| Semicossyphus pulcher female | | 0.7500 | 0.7538 |
| 12 | | | |
| | 900725 | 0.5000 | 1.0000 |
| 4 | | | |
| | 900925 | 0.8750 | 0.6409 |
| 8 | | | |
| Embiotoca jacksoni adult | | 0.8333 | 1.0299 |
| 12 | | | |
| | 900725 | 0.7500 | 0.9574 |
| 4 | | | |
| | 900925 | 0.8750 | 1.1260 |
| 8 | | | |
| Embiotoca jacksoni juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900725 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900925 | 0.0000 | 0.0000 |
| 8 | | | |
| Embiotoca lateralis adult | | 3.4167 | 1.4434 |
| 12 | | | |
| | 900725 | 2.5000 | 1.7321 |
| 4 | | | |
| | 900925 | 3.8750 | 1.1260 |
| 8 | | | |
| Embiotoca lateralis juvenile | | 1.0833 | 1.1645 |
| 12 | | | |
| | 900725 | 0.5000 | 0.5774 |
| 4 | | | |
| | 900925 | 1.3750 | 1.3025 |
| 8 | | | |
| Damalichthys vacca adult | | 2.2500 | 2.2613 |
| 12 | | | |
| | 900725 | 0.2500 | 0.5000 |
| 4 | | | |

| | | | |
|---|---|---|---|
| | 900925 | 3.2500 | 2.1213 |
| 8 | | | |
| Damalichthys vacca juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900725 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900925 | 0.0000 | 0.0000 |
| 8 | | | |
| Hypsypops rubicundus adult | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900725 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900925 | 0.0000 | 0.0000 |
| 8 | | | |
| Hypsypops rubicundus juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900725 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900925 | 0.0000 | 0.0000 |
| 8 | | | |
| Girella nigricans adult | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900725 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900925 | 0.0000 | 0.0000 |
| 8 | | | |
| Girella nigricans juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900725 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900925 | 0.0000 | 0.0000 |
| 8 | | | |

# LOCATION 2 SAN MIGUEL ISLAND - HARE ROCK
# 1990 SIZE FREQUENCY DISTRIBUTIONS

## Tethya aurantia

| | |
|---|---|
| (cases) N= | 58 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 5.2% |
| 30 - 39 | 15.5% |
| 40 - 49 | 8.6% |
| 50 - 59 | 22.4% |
| 60 - 69 | 22.4% |
| 70 - 79 | 15.5% |
| 80 - 89 | 6.9% |
| 90 - 99 | 1.7% |
| > 99 | 1.7% |
| min size (mm) | 22 |
| max size (mm) | 104 |
| mean | 58 |
| mode | 36 |

## Cypraea spadicea

| | |
|---|---|
| (cases) N= | 43 |
| < 30 | 2.3% |
| 30 - 34 | 0.0 |
| 35 - 39 | 2.3% |
| 40 - 44 | 23.3% |
| 45 - 49 | 34.9% |
| 50 - 54 | 30.2% |
| 55 - 59 | 4.7% |
| > 59 | 0.0 |
| min size (mm) | 9 |
| max size (mm) | 60 |
| mean | 47 |
| mode | 50 |

## Haliotis rufescens

| | |
|---|---|
| (cases) N= | 24 |
| < 25 | 58.3% |
| 25 - 29 | 16.7% |
| 30 - 34 | 16.7% |
| 35 - 39 | 4.2% |
| 40 - 44 | 0.0 |
| 45 - 49 | 0.0 |
| 50 - 54 | 0.0 |
| 55 - 59 | 0.0 |
| 60 - 64 | 0.0 |
| 65 - 69 | 0.0 |
| 70 - 74 | 0.0 |
| 75 - 79 | 0.0 |
| 80 - 84 | 0.0 |
| 85 - 90 | 0.0 |
| 90 - 94 | 0.0 |
| 95 - 99 | 0.0 |
| 100 - 104 | 0.0 |
| 105 - 109 | 0.0 |
| 110 - 114 | 0.0 |
| 115 - 119 | 0.0 |
| 120 - 124 | 0.0 |
| 125 - 129 | 0.0 |
| 130 - 134 | 0.0 |
| 135 - 139 | 0.0 |
| 140 - 144 | 0.0 |
| 145 - 149 | 0.0 |
| 150 - 154 | 0.0 |
| 155 - 159 | 0.0 |
| 160 - 164 | 0.0 |
| 165 - 169 | 0.0 |
| 170 - 174 | 4.2% |
| 175 - 179 | 0.0 |
| 180 - 184 | 0.0 |
| 185 - 189 | 0.0 |
| 190 - 194 | 0.0 |
| 195 - 199 | 0.0 |
| > 199 | 0.0 |
| min size (mm) | 10 |
| max size (mm) | 173 |
| mean | 30 |
| mode | 22 |

Patiria miniata

| | |
|---|---|
| (cases) N= | 51 |
| < 10 | 2.0% |
| 10 - 19 | 7.8% |
| 20 - 29 | 5.9% |
| 30 - 39 | 0.0 |
| 40 - 49 | 9.8% |
| 50 - 59 | 19.6% |
| 60 - 69 | 37.3% |
| 70 - 79 | 17.6% |
| 80 - 89 | 0.0 |
| 90 - 99 | 0.0 |
| > 99 | 0.0 |
| min size (mm) | 6 |
| max size (mm) | 75 |
| mean | 54 |
| mode | 62 |

Pisaster giganteus

| | |
|---|---|
| (cases) N= | 51 |
| < 20 | 0.0 |
| 20 - 39 | 2.0% |
| 40 - 59 | 27.5% |
| 60 - 79 | 33.3% |
| 80 - 99 | 21.6% |
| 100 - 119 | 9.8% |
| 120 - 139 | 3.9% |
| 140 - 159 | 0.0 |
| 160 - 179 | 0.0 |
| 180 - 199 | 2.0% |
| 200 - 219 | 0.0 |
| 220 - 239 | 0.0 |
| 240 - 259 | 0.0 |
| 260 - 279 | 0.0 |
| 280 - 299 | 0.0 |
| > 299 | 0.0 |
| min size (mm) | 34 |
| max size (mm) | 193 |
| mean | 77 |
| mode | 68 |

Pycnopodia helianthoides

| | |
|---|---|
| (cases) N= | 46 |
| < 20 | 0.0 |
| 20 - 39 | 4.3% |
| 40 - 59 | 2.2% |
| 60 - 79 | 0.0 |
| 80 - 99 | 10.9% |
| 100 - 119 | 6.5% |
| 120 - 139 | 19.6% |
| 140 - 159 | 4.3% |
| 160 - 179 | 8.7% |
| 180 - 199 | 8.7% |
| 200 - 219 | 10.9% |
| 220 - 239 | 10.9% |
| 240 - 259 | 4.3% |
| 260 - 279 | 6.5% |
| 280 - 299 | 2.2% |
| > 299 | 0.0 |
| min size (mm) | 29 |
| max size (mm) | 293 |
| mean | 163 |
| mode | 182 |

Parastichopus parvimensis

| | |
|---|---|
| (cases) N= | 30 |
| < 5 | 0.0 |
| 5 - 6 | 0.0 |
| 7 - 8 | 0.0 |
| 9 - 10 | 0.0 |
| 11 - 12 | 0.0 |
| 13 - 14 | 10.0% |
| 15 - 16 | 26.7% |
| 17 - 18 | 36.7% |
| 19 - 20 | 20.0% |
| 21 - 22 | 3.3% |
| > 22 | 3.3% |
| min size (cm) | 14 |
| max size (cm) | 24 |
| mean | 17 |
| mode | 18 |

## LOCATION 2 SAN MIGUEL ISLAND - HARE ROCK

| Strongylocentrotus franciscanus | |
|---|---|
| (cases) N= | 102 |
| < 5 | 0.0 |
| 5 - 9 | 0.0 |
| 10 - 14 | 0.0 |
| 15 - 19 | 0.0 |
| 20 - 24 | 0.0 |
| 25 - 29 | 2.9% |
| 30 - 34 | 4.9% |
| 35 - 39 | 3.9% |
| 40 - 44 | 10.8% |
| 45 - 49 | 3.9% |
| 50 - 54 | 5.9% |
| 55 - 59 | 10.8% |
| 60 - 64 | 21.6% |
| 65 - 69 | 15.7% |
| 70 - 74 | 10.8% |
| 75 - 79 | 5.9% |
| 80 - 84 | 2.0% |
| 85 - 90 | 1.0% |
| 90 - 94 | 0.0 |
| 95 - 99 | 0.0 |
| 100 - 104 | 0.0 |
| 105 - 109 | 0.0 |
| > 109 | 0.0 |
| min size (mm) | 28 |
| max size (mm) | 87 |
| mean | 58 |
| mode | 60 |

| Strongylocentrotus purpuratus | |
|---|---|
| (cases) N= | 110 |
| < 5 | 0.0 |
| 5 - 9 | 0.9% |
| 10 - 14 | 0.0 |
| 15 - 19 | 0.0 |
| 20 - 24 | 1.8% |
| 25 - 29 | 5.5% |
| 30 - 34 | 26.4% |
| 35 - 39 | 35.5% |
| 40 - 44 | 18.2% |
| 45 - 49 | 6.4% |
| 50 - 54 | 1.8% |
| 55 - 59 | 1.8% |
| 60 - 64 | 1.8% |
| 65 - 69 | 0.0 |
| 70 - 74 | 0.0 |
| 75 - 79 | 0.0 |
| 80 - 84 | 0.0 |
| 85 - 90 | 0.0 |
| 90 - 94 | 0.0 |
| 95 - 99 | 0.0 |
| 100 - 104 | 0.0 |
| 105 - 109 | 0.0 |
| > 109 | 0.0 |
| min size (mm) | 6 |
| max size (mm) | 63 |
| mean | 37 |
| mode | 38 |

LOCATION 3 SANTA ROSA ISLAND - JOHNSON'S LEE NORTH

1990 QUADRAT DATA: MEAN NUMBER PER $M^2$

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Macrocystis pyrifera adult | 1.2000 | 1.0183 | 20 |
| Eisenia arborea | 0.0250 | 0.1118 | 20 |
| Pterygophora californica | 0.3250 | 0.4064 | 20 |
| Laminaria farlowii | 0.1750 | 0.2936 | 20 |
| Macrocystis pyrifera juvenile | 0.9250 | 1.4260 | 20 |
| Macrocystis pyrifera all | 2.1250 | 1.6212 | 20 |
| Cypraea spadicea | 0.4000 | 0.5758 | 20 |
| Astraea undosa | 0.0000 | 0.0000 | 20 |
| Patiria miniata | 0.5500 | 0.6048 | 20 |
| Pisaster giganteus | 1.0000 | 0.8429 | 20 |
| Strongylocentrotus franciscanus | 0.1750 | 0.5911 | 20 |
| Strongylocentrotus purpuratus | 1.1000 | 2.0686 | 20 |
| Parastichopus parvimensis | 0.5750 | 0.5200 | 20 |
| Styela monteryensis | 1.2750 | 1.2511 | 20 |
| Lythrypnus dalli | 0.0000 | 0.0000 | 20 |
| Coryphopterus nicholsii | 0.0250 | 0.1118 | 20 |
| Alloclinus holderi | 0.0500 | 0.1539 | 20 |

1990 BAND TRANSECT: MEAN NUMBER PER $M^2$

| | | | |
|---|---|---|---|
| Tethya aurantia | 0.0181 | 0.0241 | 12 |
| Allopora californica | 0.0000 | 0.0000 | 12 |
| Tealia lofotensis | 0.0153 | 0.0207 | 12 |
| Lophogorgia chilensis | 0.0028 | 0.0065 | 12 |
| Muricea fruticosa | 0.0000 | 0.0000 | 12 |
| Panulirus interruptus | 0.0000 | 0.0000 | 12 |
| Haliotis rufescens | 0.0083 | 0.0241 | 12 |
| Haliotis corrugata | 0.0000 | 0.0000 | 12 |
| Haliotis fulgens | 0.0000 | 0.0000 | 12 |
| Kelletia kelletii | 0.0014 | 0.0048 | 12 |
| Megathura crenulata | 0.0222 | 0.0205 | 12 |
| Hinnites giganteus | 0.0139 | 0.0172 | 12 |
| Aplysia californica | 0.0000 | 0.0000 | 12 |
| Pycnopodia helianthoides | 0.2458 | 0.0856 | 12 |
| Lytechinus anamesus | 0.0000 | 0.0000 | 12 |

LOCATION 3 SANTA ROSA ISLAND - JOHNSON'S LEE NORTH
1990 RANDOM POINT CONTACT DATA: MEAN PERCENT COVER

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Green algae | 0.1000 | 0.5000 | 25 |
| Miscellaneous brown algae | 2.6000 | 3.7832 | 25 |
| Desmarestia spp. | 0.0000 | 0.0000 | 25 |
| Laminaria farlowii | 0.8000 | 2.3629 | 25 |
| Cystoseira spp. | 9.1000 | 19.1877 | 25 |
| Macrocystis, Eisenia, Pterygophora | 41.8000 | 21.6449 | 25 |
| Miscellaneous red algae | 27.8000 | 14.1480 | 25 |
| Articulated coralline algae | 8.1000 | 7.5788 | 25 |
| Crustose coralline algae | 16.2000 | 7.2212 | 25 |
| Gelidium spp. | 0.0000 | 0.0000 | 25 |
| Gigartina spp. | 0.0000 | 0.0000 | 25 |
| Miscellaneous plants | 1.4000 | 1.9203 | 25 |
| Sponges | 3.2000 | 3.9870 | 25 |
| Corynactis californica | 3.9000 | 6.3361 | 25 |
| Balanophyllia elegans | 6.2000 | 4.7390 | 25 |
| Astrangia lajollaensis | 1.2000 | 2.6141 | 25 |
| Diopatra ornata | 1.2000 | 4.0260 | 25 |
| Phragmatopoma californica | 14.0000 | 9.3541 | 25 |
| Serpulorbis squamigerus | 0.1000 | 0.5000 | 25 |
| Bryozoans, other | 15.0000 | 11.0161 | 25 |
| Diaperoecia californica | 0.8000 | 1.3919 | 25 |
| Tunicates | 4.5000 | 3.5355 | 25 |
| Miscellaneous invertebrates | 14.6000 | 7.9281 | 25 |
| Bare substrate | 5.9000 | 6.2032 | 25 |
| Rock | 90.3000 | 11.3496 | 25 |
| Cobble | 1.3000 | 2.1794 | 25 |
| Sand | 8.4000 | 11.7898 | 25 |

1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| | | | |
|---|---|---|---|
| TOTAL FISH ABUNDANCE | 2.1111 | 3.2712 | 144 |
| Chromis punctipinnis | 3.2500 | 4.1806 | 12 |
| Oxyjulis californica | 3.5000 | 5.6003 | 12 |
| Sebastes mystinus | 0.2500 | 0.4523 | 12 |
| Sebastes serranoides | 0.2500 | 0.4523 | 12 |
| Sebastes atrovirens | 2.0000 | 1.4142 | 12 |
| Paralabrax clathratus | 0.4167 | 0.6686 | 12 |
| Semicossyphus pulcher | 0.7500 | 0.7538 | 12 |
| Embiotoca jacksoni | 6.8333 | 3.5119 | 12 |
| Embiotoca lateralis | 5.5833 | 3.5792 | 12 |
| Damalichthys vacca | 1.1667 | 1.1934 | 12 |
| Hypsypops rubicundus | 0.9167 | 0.6686 | 12 |
| Girella nigricans | 0.4167 | 0.6686 | 12 |

LOCATION 3 SANTA ROSA ISLAND - JOHNSON'S LEE NORTH
1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| Species | Date (year/month/day) | Mean | Std Dev | Cases |
|---|---|---|---|---|
| Chromis punctipinnis adult | | 1.7500 | 3.1370 | 12 |
| | 900808 | 1.0000 | 1.4142 | 4 |
| | 900915 | 2.1250 | 3.7583 | 8 |
| Chromis punctipinnis juvenile | | 1.5000 | 2.6112 | 12 |
| | 900808 | 4.0000 | 3.3665 | 4 |
| | 900915 | 0.2500 | 0.7071 | 8 |
| Oxyjulis californica adult | | 1.0833 | 1.9752 | 12 |
| | 900808 | 3.2500 | 2.2174 | 4 |
| | 900915 | 0.0000 | 0.0000 | 8 |
| Oxyjulis californica juvenile | | 2.4167 | 5.7597 | 12 |
| | 900808 | 0.0000 | 0.0000 | 4 |
| | 900915 | 3.6250 | 6.8648 | 8 |
| Sebastes mystinus adult | | 0.2500 | 0.4523 | 12 |
| | 900808 | 0.0000 | 0.0000 | 4 |
| | 900915 | 0.3750 | 0.5175 | 8 |
| Sebastes mystinus juvenile | | 0.0000 | 0.0000 | 12 |
| | 900808 | 0.0000 | 0.0000 | 4 |
| | 900915 | 0.0000 | 0.0000 | 8 |
| Sebastes serranoides adult | | 0.2500 | 0.4523 | 12 |
| | 900808 | 0.2500 | 0.5000 | 4 |
| | 900915 | 0.2500 | 0.4629 | 8 |

| | | | |
|---|---|---|---|
| Sebastes serranoides juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900808 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900915 | 0.0000 | 0.0000 |
| 8 | | | |
| Sebastes atrovirens adult | | 2.0000 | 1.4142 |
| 12 | | | |
| | 900808 | 1.7500 | 1.5000 |
| 4 | | | |
| | 900915 | 2.1250 | 1.4577 |
| 8 | | | |
| Sebastes atrovirens juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900808 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900915 | 0.0000 | 0.0000 |
| 8 | | | |
| Paralabrax clathratus adult | | 0.4167 | 0.6686 |
| 12 | | | |
| | 900808 | 0.7500 | 0.9574 |
| 4 | | | |
| | 900915 | 0.2500 | 0.4629 |
| 8 | | | |

| | | | |
|---|---|---|---|
| Paralabrax clathratus juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900808 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900915 | 0.0000 | 0.0000 |
| 8 | | | |
| Semicossyphus pulcher male | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900808 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900915 | 0.0000 | 0.0000 |
| 8 | | | |
| Semicossyphus pulcher female | | 0.7500 | 0.7538 |
| 12 | | | |
| | 900808 | 0.7500 | 0.9574 |
| 4 | | | |
| | 900915 | 0.7500 | 0.7071 |
| 8 | | | |
| Embiotoca jacksoni adult | | 5.8333 | 3.6886 |
| 12 | | | |
| | 900808 | 5.2500 | 3.5000 |
| 4 | | | |
| | 900915 | 6.1250 | 3.9799 |
| 8 | | | |
| Embiotoca jacksoni juvenile | | 1.0000 | 1.4771 |
| 12 | | | |
| | 900808 | 1.7500 | 2.3629 |
| 4 | | | |
| | 900915 | 0.6250 | 0.7440 |
| 8 | | | |
| Embiotoca lateralis adult | | 4.5000 | 3.3439 |
| 12 | | | |
| | 900808 | 4.0000 | 2.8284 |
| 4 | | | |
| | 900915 | 4.7500 | 3.7321 |
| 8 | | | |
| Embiotoca lateralis juvenile | | 1.0833 | 1.6214 |
| 12 | | | |
| | 900808 | 1.7500 | 2.3629 |
| 4 | | | |
| | 900915 | 0.7500 | 1.1650 |
| 8 | | | |
| Damalichthys vacca adult | | 0.7500 | 0.8660 |
| 12 | | | |
| | 900808 | 0.7500 | 0.9574 |
| 4 | | | |

| | | | |
|---|---|---|---|
| | 900915 | 0.7500 | 0.8864 |
| 8 | | | |
| Damalichthys vacca juvenile | | 0.4167 | 1.1645 |
| 12 | | | |
| | 900808 | 1.0000 | 2.0000 |
| 4 | | | |
| | 900915 | 0.1250 | 0.3536 |
| 8 | | | |
| Hypsypops rubicundus adult | | 0.9167 | 0.6686 |
| 12 | | | |
| | 900808 | 1.5000 | 0.5774 |
| 4 | | | |
| | 900915 | 0.6250 | 0.5175 |
| 8 | | | |
| Hypsypops rubicundus juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900808 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900915 | 0.0000 | 0.0000 |
| 8 | | | |
| Girella nigricans adult | | 0.4167 | 0.6686 |
| 12 | | | |
| | 900808 | 0.7500 | 0.9574 |
| 4 | | | |
| | 900915 | 0.2500 | 0.4629 |
| 8 | | | |
| Girella nigricans juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900808 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900915 | 0.0000 | 0.0000 |
| 8 | | | |

LOCATION 3 SANTA ROSA ISLAND - JOHNSON'S LEE NORTH
1990 SIZE FREQUENCY DISTRIBUTIONS

Tethya aurantia

| | |
|---|---|
| (cases) N= | 23 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 13.0% |
| 30 - 39 | 13.0% |
| 40 - 49 | 13.0% |
| 50 - 59 | 13.0% |
| 60 - 69 | 4.3% |
| 70 - 79 | 13.0% |
| 80 - 89 | 4.3% |
| 90 - 99 | 4.3% |
| > 99 | 17.4% |
| min size (mm) | 26 |
| max size (mm) | 107 |
| mean | 65 |
| mode | 78 |

Astraea undosa

| | |
|---|---|
| (cases) N= | 11 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 0.0 |
| 30 - 39 | 0.0 |
| 40 - 49 | 0.0 |
| 50 - 59 | 9.1% |
| 60 - 69 | 0.0 |
| 70 - 79 | 0.0 |
| 80 - 89 | 9.1% |
| 90 - 99 | 9.1% |
| 100 - 109 | 54.5% |
| 110 - 119 | 9.1% |
| > 119 | 9.1% |
| min size (mm) | 53 |
| max size (mm) | 154 |
| mean | 104 |
| mode | 105 |

Cypraea spadicea

| | |
|---|---|
| (cases) N= | 44 |
| < 30 | 0.0 |
| 30 - 34 | 0.0 |
| 35 - 39 | 2.3% |
| 40 - 44 | 18.2% |
| 45 - 49 | 47.7% |
| 50 - 54 | 27.3% |
| 55 - 59 | 4.5% |
| > 59 | 0.0 |
| min size (mm) | 38 |
| max size (mm) | 56 |
| mean | 48 |
| mode | 46 |

Haliotis rufescens

| | |
|---|---|
| (cases) N= | 33 |
| < 25 | 0.0 |
| 25 - 29 | 3.0% |
| 30 - 34 | 3.0% |
| 35 - 39 | 0.0 |
| 40 - 44 | 9.1% |
| 45 - 49 | 3.0% |
| 50 - 54 | 6.1% |
| 55 - 59 | 9.1% |
| 60 - 64 | 3.0% |
| 65 - 69 | 6.1% |
| 70 - 74 | 3.0% |
| 75 - 79 | 0.0 |
| 80 - 84 | 0.0 |
| 85 - 90 | 3.0% |
| 90 - 94 | 9.1% |
| 95 - 99 | 3.0% |
| 100 - 104 | 3.0% |
| 105 - 109 | 3.0% |
| 110 - 114 | 3.0% |
| 115 - 119 | 0.0 |
| 120 - 124 | 3.0% |
| 125 - 129 | 0.0 |
| 130 - 134 | 3.0% |
| 135 - 139 | 0.0 |
| 140 - 144 | 0.0 |
| 145 - 149 | 6.1% |
| 150 - 154 | 0.0 |
| 155 - 159 | 6.1% |
| 160 - 164 | 0.0 |
| 165 - 169 | 3.0% |
| 170 - 174 | 0.0 |
| 175 - 179 | 0.0 |
| 180 - 184 | 6.1% |
| 185 - 189 | 0.0 |
| 190 - 194 | 3.0% |
| 195 - 199 | 0.0 |
| > 199 | 0.0 |
| min size (mm) | 28 |
| max size (mm) | 190 |
| mean | 95 |
| mode | 59 |

Megathura crenulata

| | |
|---|---|
| (cases) N= | 24 |
| < 10 | 0.0 |
| 10 - 19 | 4.2% |
| 20 - 29 | 4.2% |
| 30 - 39 | 0.0 |
| 40 - 49 | 0.0 |
| 50 - 59 | 0.0 |
| 60 - 69 | 4.2% |
| 70 - 79 | 8.3% |
| 80 - 89 | 4.2% |
| 90 - 99 | 16.7% |
| 100 - 109 | 25.0% |
| 110 - 119 | 12.5% |
| > 119 | 20.8% |
| min size (mm) | 18 |
| max size (mm) | 129 |
| mean | 96 |
| mode | 102 |

Hinnites giganteus

| | |
|---|---|
| (cases) N= | 27 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 7.4% |
| 30 - 39 | 3.7% |
| 40 - 49 | 0.0 |
| 50 - 59 | 7.4% |
| 60 - 69 | 14.8% |
| 70 - 79 | 14.8% |
| 80 - 89 | 11.1% |
| 90 - 99 | 3.7% |
| 100 - 109 | 7.4% |
| 110 - 119 | 18.5% |
| 120 - 129 | 3.7% |
| 130 - 139 | 0.0 |
| 140 - 149 | 3.7% |
| > 149 | 3.7% |
| min size (mm) | 29 |
| max size (mm) | 154 |
| mean | 85 |
| mode | 29 |

Patiria miniata

| | |
|---|---|
| (cases) N= | 50 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 0.0 |
| 30 - 39 | 2.0% |
| 40 - 49 | 12.0% |
| 50 - 59 | 28.0% |
| 60 - 69 | 30.0% |
| 70 - 79 | 24.0% |
| 80 - 89 | 2.0% |
| 90 - 99 | 2.0% |
| > 99 | 0.0 |
| min size (mm) | 35 |
| max size (mm) | 90 |
| mean | 62 |
| mode | 59 |

Pisaster giganteus

| | |
|---|---|
| (cases) N= | 53 |
| < 20 | 1.9% |
| 20 - 39 | 7.5% |
| 40 - 59 | 11.3% |
| 60 - 79 | 34.0% |
| 80 - 99 | 34.0% |
| 100 - 119 | 5.7% |
| 120 - 139 | 1.9% |
| 140 - 159 | 0.0 |
| 160 - 179 | 1.9% |
| 180 - 199 | 1.9% |
| 200 - 219 | 0.0 |
| 220 - 239 | 0.0 |
| 240 - 259 | 0.0 |
| 260 - 279 | 0.0 |
| 280 - 299 | 0.0 |
| > 299 | 0.0 |
| min size (mm) | 17 |
| max size (mm) | 187 |
| mean | 78 |
| mode | 63 |

# LOCATION 3 SANTA ROSA ISLAND - JOHNSON'S LEE NORTH

## Pycnopodia helianthoides

| | |
|---|---|
| (cases) N= | 48 |
| < 20 | 0.0 |
| 20 - 39 | 2.1% |
| 40 - 59 | 8.3% |
| 60 - 79 | 18.8% |
| 80 - 99 | 22.9% |
| 100 - 119 | 29.2% |
| 120 - 139 | 6.3% |
| 140 - 159 | 2.1% |
| 160 - 179 | 2.1% |
| 180 - 199 | 0.0 |
| 200 - 219 | 0.0 |
| 220 - 239 | 2.1% |
| 240 - 259 | 4.2% |
| 260 - 279 | 2.1% |
| 280 - 299 | 0.0 |
| > 299 | 0.0 |
| min size (mm) | 33 |
| max size (mm) | 270 |
| mean | 104 |
| mode | 100 |

## Parastichopus parvimensis

| | |
|---|---|
| (cases) N= | 39 |
| < 5 | 0.0 |
| 5 - 6 | 2.6% |
| 7 - 8 | 0.0 |
| 9 - 10 | 12.8% |
| 11 - 12 | 30.8% |
| 13 - 14 | 35.9% |
| 15 - 16 | 17.9% |
| 17 - 18 | 0.0 |
| 19 - 20 | 0.0 |
| 21 - 22 | 0.0 |
| > 22 | 0.0 |
| min size (cm) | 6 |
| max size (cm) | 16 |
| mean | 13 |
| mode | 13 |

## Strongylocentrotus franciscanus

| | |
|---|---|
| (cases) N= | 94 |
| < 5 | 0.0 |
| 5 - 9 | 0.0 |
| 10 - 14 | 0.0 |
| 15 - 19 | 0.0 |
| 20 - 24 | 0.0 |
| 25 - 29 | 5.3% |
| 30 - 34 | 5.3% |
| 35 - 39 | 2.1% |
| 40 - 44 | 4.3% |
| 45 - 49 | 5.3% |
| 50 - 54 | 3.2% |
| 55 - 59 | 5.3% |
| 60 - 64 | 7.4% |
| 65 - 69 | 8.5% |
| 70 - 74 | 11.7% |
| 75 - 79 | 11.7% |
| 80 - 84 | 10.6% |
| 85 - 90 | 5.3% |
| 90 - 94 | 6.4% |
| 95 - 99 | 3.2% |
| 100 - 104 | 1.1% |
| 105 - 109 | 2.1% |
| > 109 | 0.0 |
| min size (mm) | 25 |
| max size (mm) | 110 |
| mean | 67 |
| mode | 92 |

## Strongylocentrotus purpuratus

| | |
|---|---|
| (cases) N= | 111 |
| < 5 | 0.0 |
| 5 - 9 | 0.0 |
| 10 - 14 | 6.3% |
| 15 - 19 | 9.0% |
| 20 - 24 | 8.1% |
| 25 - 29 | 10.8% |
| 30 - 34 | 18.9% |
| 35 - 39 | 19.8% |
| 40 - 44 | 18.0% |
| 45 - 49 | 4.5% |
| 50 - 54 | 3.6% |
| 55 - 59 | 0.9% |
| 60 - 64 | 0.0 |
| 65 - 69 | 0.0 |
| 70 - 74 | 0.0 |
| 75 - 79 | 0.0 |
| 80 - 84 | 0.0 |
| 85 - 90 | 0.0 |
| 90 - 94 | 0.0 |
| 95 - 99 | 0.0 |
| 100 - 104 | 0.0 |
| 105 - 109 | 0.0 |
| > 109 | 0.0 |
| min size (mm) | 10 |
| max size (mm) | 59 |
| mean | 33 |
| mode | 39 |

# LOCATION 3 SANTA ROSA ISLAND - JOHNSON'S LEE NORTH

Macrocystis pyrifera numbers of stipes.

| | |
|---|---|
| (cases) N= | 102 |
| < 3 | 8.8% |
| 3 - 5 | 20.6% |
| 6 - 8 | 25.5% |
| 9 - 11 | 21.6% |
| 12 - 14 | 14.7% |
| 15 - 17 | 6.9% |
| 18 - 20 | 0.0 |
| 21 - 23 | 1.0% |
| 24 - 26 | 1.0% |
| 27 - 29 | 0.0 |
| 30 - 32 | 0.0 |
| 33 - 35 | 0.0 |
| 36 - 38 | 0.0 |
| 39 - 41 | 0.0 |
| 42 - 44 | 0.0 |
| >44 | 0.0 |
| min number | 1 |
| max number | 24 |
| mean | 8 |
| mode | 8 |

Macrocystis pyrifera holdfast diameters.

| | |
|---|---|
| (cases) N= | 102 |
| < 6 | 0.0 |
| 6 - 11 | 2.0% |
| 12 - 17 | 4.9% |
| 18 - 23 | 7.8% |
| 24 - 29 | 14.7% |
| 30 - 35 | 12.7% |
| 36 - 41 | 19.6% |
| 42 - 47 | 21.6% |
| 48 - 53 | 8.8% |
| 54 - 59 | 7.8% |
| 60 - 65 | 0.0 |
| 66 - 71 | 0.0 |
| 72 - 77 | 0.0 |
| 78 - 83 | 0.0 |
| 84 - 89 | 0.0 |
| >89 | 0.0 |
| min width (cm) | 8 |
| max width (cm) | 59 |
| mean | 36 |
| mode | 39 |

LOCATION 4 SANTA ROSA ISLAND - JOHNSON'S LEE SOUTH

1990 QUADRAT DATA: MEAN NUMBER PER $M^2$

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Macrocystis pyrifera adult | 0.4750 | 0.5955 | 20 |
| Eisenia arborea | 0.0500 | 0.1539 | 20 |
| Pterygophora californica | 0.5250 | 1.0572 | 20 |
| Laminaria farlowii | 0.4000 | 0.4757 | 20 |
| Macrocystis pyrifera juvenile | 0.1750 | 0.4667 | 20 |
| Macrocystis pyrifera all | 0.6500 | 0.7797 | 20 |
| Cypraea spadicea | 0.4250 | 0.5911 | 20 |
| Astraea undosa | 0.0000 | 0.0000 | 20 |
| Patiria miniata | 2.5750 | 1.7492 | 20 |
| Pisaster giganteus | 0.1750 | 0.4064 | 20 |
| Strongylocentrotus franciscanus | 1.0250 | 1.4000 | 20 |
| Strongylocentrotus purpuratus | 11.0500 | 17.8192 | 20 |
| Parastichopus parvimensis | 0.1250 | 0.2751 | 20 |
| Styela monteryensis | 0.8750 | 0.9580 | 20 |
| Lythrypnus dalli | 0.0000 | 0.0000 | 20 |
| Coryphopterus nicholsii | 0.4250 | 0.7826 | 20 |
| Alloclinus holderi | 0.1250 | 0.2751 | 20 |

1990 BAND TRANSECT DATA: MEAN NUMBER PER $M^2$

| | | | |
|---|---|---|---|
| Tethya aurantia | 0.0764 | 0.0597 | 12 |
| Allopora californica | 0.0000 | 0.0000 | 12 |
| Tealia lofotensis | 0.0625 | 0.0823 | 12 |
| Lophogorgia chilensis | 0.1931 | 0.0633 | 12 |
| Muricea fruticosa | 0.0014 | 0.0048 | 12 |
| Panulirus interruptus | 0.0000 | 0.0000 | 12 |
| Haliotis rufescens | 0.0028 | 0.0065 | 12 |
| Haliotis corrugata | 0.0000 | 0.0000 | 12 |
| Haliotis fulgens | 0.0000 | 0.0000 | 12 |
| Kelletia kelletii | 0.0069 | 0.0111 | 12 |
| Megathura crenulata | 0.0028 | 0.0065 | 12 |
| Hinnites giganteus | 0.0097 | 0.0207 | 12 |
| Aplysia californica | 0.0000 | 0.0000 | 12 |
| Pycnopodia helianthoides | 0.2597 | 0.1810 | 12 |
| Lytechinus anamesus | 0.0000 | 0.0000 | 12 |

LOCATION 4 SANTA ROSA ISLAND - JOHNSON'S LEE SOUTH
1990 RANDOM POINT CONTACT DATA: MEAN PERCENT COVER

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Green algae | 0.0000 | 0.0000 | 25 |
| Miscellaneous brown algae | 1.5000 | 2.7003 | 25 |
| Desmarestia spp. | 0.0000 | 0.0000 | 25 |
| Laminaria farlowii | 2.1000 | 3.0345 | 25 |
| Cystoseira spp. | 1.0000 | 1.6137 | 25 |
| Macrocystis, Eisenia, Pterygophora | 17.1000 | 16.9509 | 25 |
| Miscellaneous red algae | 18.0000 | 8.2285 | 25 |
| Articulated coralline algae | 6.9000 | 6.6646 | 25 |
| Crustose coralline algae | 19.0000 | 10.1807 | 25 |
| Gelidium spp. | 0.0000 | 0.0000 | 25 |
| Gigartina spp. | 2.5000 | 4.0825 | 25 |
| Miscellaneous plants | 0.4000 | 0.9354 | 25 |
| Sponges | 1.3000 | 2.1794 | 25 |
| Corynactis californica | 4.1000 | 8.0971 | 25 |
| Balanophyllia elegans | 10.8000 | 7.2428 | 25 |
| Astrangia lajollaensis | 1.3000 | 2.1794 | 25 |
| Diopatra ornata | 7.2000 | 6.3459 | 25 |
| Phragmatopoma californica | 0.0000 | 0.0000 | 25 |
| Serpulorbis squamigerus | 0.0000 | 0.0000 | 25 |
| Bryozoans, others | 17.3000 | 7.5319 | 25 |
| Diaperoecia californica | 0.5000 | 1.6137 | 25 |
| Tunicates | 3.8000 | 5.5019 | 25 |
| Miscellaneous invertebrates | 26.8000 | 14.0223 | 25 |
| Bare substrate | 10.4000 | 8.0906 | 25 |
| Rock | 82.2000 | 12.7949 | 25 |
| Cobble | 2.1000 | 2.9475 | 25 |
| Sand | 15.7000 | 12.5938 | 25 |

1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| | | | |
|---|---|---|---|
| TOTAL FISH ABUNDANCE | 2.2431 | 3.0640 | 144 |
| Chromis punctipinnis | 5.1667 | 4.8959 | 12 |
| Oxyjulis californica | 1.0833 | 1.6214 | 12 |
| Sebastes mystinus | 5.4167 | 5.3845 | 12 |
| Sebastes serranoides | 0.3333 | 0.6513 | 12 |
| Sebastes atrovirens | 1.8333 | 1.4668 | 12 |
| Paralabrax clathratus | 0.5000 | 0.6742 | 12 |
| Semicossyphus pulcher | 2.7500 | 1.4848 | 12 |
| Embiotoca jacksoni | 2.3333 | 1.9228 | 12 |
| Embiotoca lateralis | 3.4167 | 2.4293 | 12 |
| Damalichthys vacca | 3.7500 | 2.8002 | 12 |
| Hypsypops rubicundus | 0.0000 | 0.0000 | 12 |
| Girella nigricans | 0.3333 | 0.8876 | 12 |

LOCATION 4 SANTA ROSA ISLAND - JOHNSON'S LEE SOUTH
1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| Species | Date (year/month/day) | Mean | Std Dev | Cases |
|---|---|---|---|---|
| Chromis punctipinnis adult | | 4.3333 | 4.0302 | 12 |
| | 900807 | 2.0000 | 2.1602 | 4 |
| | 900913 | 5.5000 | 4.3425 | 8 |
| Chromis punctipinnis juvenile | | 0.8333 | 2.8868 | 12 |
| | 900807 | 0.0000 | 0.0000 | 4 |
| | 900913 | 1.2500 | 3.5355 | 8 |
| Oxyjulis californica adult | | 1.0833 | 1.6214 | 12 |
| | 900807 | 0.0000 | 0.0000 | 4 |
| | 900913 | 1.6250 | 1.7678 | 8 |
| Oxyjulis californica juvenile | | 0.0000 | 0.0000 | 12 |
| | 900807 | 0.0000 | 0.0000 | 4 |
| | 900913 | 0.0000 | 0.0000 | 8 |
| Sebastes mystinus adult | | 1.0833 | 1.4434 | 12 |
| | 900807 | 0.2500 | 0.5000 | 4 |
| | 900913 | 1.5000 | 1.6036 | 8 |
| Sebastes mystinus juvenile | | 4.3333 | 4.5991 | 12 |
| | 900807 | 0.0000 | 0.0000 | 4 |
| | 900913 | 6.5000 | 4.1404 | 8 |
| Sebastes serranoides adult | | 0.0833 | 0.2887 | 12 |
| | 900807 | 0.0000 | 0.0000 | 4 |
| | 900913 | 0.1250 | 0.3536 | 8 |

| | | | |
|---|---|---|---|
| Sebastes serranoides juvenile | | 0.2500 | 0.4523 |
| 12 | | | |
| | 900807 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900913 | 0.3750 | 0.5175 |
| 8 | | | |
| Sebastes atrovirens adult | | 1.8333 | 1.4668 |
| 12 | | | |
| | 900807 | 1.5000 | 1.9149 |
| 4 | | | |
| | 900913 | 2.0000 | 1.3093 |
| 8 | | | |
| Sebastes atrovirens juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900807 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900913 | 0.0000 | 0.0000 |
| 8 | | | |
| Paralabrax clathratus adult | | 0.4167 | 0.6686 |
| 12 | | | |
| | 900807 | 0.7500 | 0.9574 |
| 4 | | | |
| | 900913 | 0.2500 | 0.4629 |
| 8 | | | |

| | | | |
|---|---|---|---|
| Paralabrax clathratus juvenile | | 0.0833 | 0.2887 |
| 12 | | | |
| | 900807 | 0.2500 | 0.5000 |
| 4 | | | |
| | 900913 | 0.0000 | 0.0000 |
| 8 | | | |
| Semicossyphus pulcher male | | 0.4167 | 0.5149 |
| 12 | | | |
| | 900807 | 0.7500 | 0.5000 |
| 4 | | | |
| | 900913 | 0.2500 | 0.4629 |
| 8 | | | |
| Semicossyphus pulcher female | | 2.3333 | 1.4355 |
| 12 | | | |
| | 900807 | 1.5000 | 1.2910 |
| 4 | | | |
| | 900913 | 2.7500 | 1.3887 |
| 8 | | | |
| Embiotoca jacksoni adult | | 2.3333 | 1.9228 |
| 12 | | | |
| | 900807 | 1.0000 | 1.4142 |
| 4 | | | |
| | 900913 | 3.0000 | 1.8516 |
| 8 | | | |
| Embiotoca jacksoni juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900807 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900913 | 0.0000 | 0.0000 |
| 8 | | | |
| Embiotoca lateralis adult | | 3.4167 | 2.4293 |
| 12 | | | |
| | 900807 | 3.0000 | 2.0000 |
| 4 | | | |
| | 900913 | 3.6250 | 2.7223 |
| 8 | | | |
| Embiotoca lateralis juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900807 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900913 | 0.0000 | 0.0000 |
| 8 | | | |
| Damalichthys vacca adult | | 3.7500 | 2.8002 |
| 12 | | | |
| | 900807 | 2.2500 | 1.5000 |
| 4 | | | |

| | | | |
|---|---|---|---|
| | 900913 | 4.5000 | 3.0706 |
| 8 | | | |
| Damalichthys vacca juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900807 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900913 | 0.0000 | 0.0000 |
| 8 | | | |
| Hypsypops rubicundus adult | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900807 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900913 | 0.0000 | 0.0000 |
| 8 | | | |
| Hypsypops rubicundus juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900807 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900913 | 0.0000 | 0.0000 |
| 8 | | | |
| Girella nigricans adult | | 0.3333 | 0.8876 |
| 12 | | | |
| | 900807 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900913 | 0.5000 | 1.0690 |
| 8 | | | |
| Girella nigricans juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900807 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900913 | 0.0000 | 0.0000 |
| 8 | | | |

# LOCATION 4 SANTA ROSA ISLAND - JOHNSON'S LEE SOUTH
# 1990 SIZE FREQUENCY DISTRIBUTIONS

## Tethya aurantia

| | |
|---|---|
| (cases) N= | 36 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 0.0 |
| 30 - 39 | 2.8% |
| 40 - 49 | 33.3% |
| 50 - 59 | 11.1% |
| 60 - 69 | 22.2% |
| 70 - 79 | 13.9% |
| 80 - 89 | 5.6% |
| 90 - 99 | 5.6% |
| > 99 | 5.6% |
| min size (mm) | 35 |
| max size (mm) | 110 |
| mean | 62 |
| mode | 42 |

## Cypraea spadicea

| | |
|---|---|
| (cases) N= | 29 |
| < 30 | 0.0 |
| 30 - 34 | 0.0 |
| 35 - 39 | 6.9% |
| 40 - 44 | 20.7% |
| 45 - 49 | 48.3% |
| 50 - 54 | 20.7% |
| 55 - 59 | 3.4% |
| > 59 | 0.0 |
| min size (mm) | 38 |
| max size (mm) | 56 |
| mean | 46 |
| mode | 46 |

## Patiria miniata

| | |
|---|---|
| (cases) N= | 51 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 3.9% |
| 30 - 39 | 5.9% |
| 40 - 49 | 9.8% |
| 50 - 59 | 27.5% |
| 60 - 69 | 25.5% |
| 70 - 79 | 21.6% |
| 80 - 89 | 3.9% |
| 90 - 99 | 2.0% |
| > 99 | 0.0 |
| min size (mm) | 21 |
| max size (mm) | 93 |
| mean | 60 |
| mode | 53 |

## Hinnites giganteus

| | |
|---|---|
| (cases) N= | 30 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 0.0 |
| 30 - 39 | 0.0 |
| 40 - 49 | 10.0% |
| 50 - 59 | 13.3% |
| 60 - 69 | 33.3% |
| 70 - 79 | 20.0% |
| 80 - 89 | 10.0% |
| 90 - 99 | 10.0% |
| 100 - 109 | 0.0 |
| 110 - 119 | 0.0 |
| 120 - 129 | 3.3% |
| 130 - 139 | 0.0 |
| 140 - 149 | 0.0 |
| > 149 | 0.0 |
| min size (mm) | 40 |
| max size (mm) | 120 |
| mean | 70 |
| mode | 62 |

## Pisaster giganteus

| | |
|---|---|
| (cases) N= | 62 |
| < 20 | 0.0 |
| 20 - 39 | 9.7% |
| 40 - 59 | 56.5% |
| 60 - 79 | 24.2% |
| 80 - 99 | 1.6% |
| 100 - 119 | 1.6% |
| 120 - 139 | 1.6% |
| 140 - 159 | 3.2% |
| 160 - 179 | 0.0 |
| 180 - 199 | 0.0 |
| 200 - 219 | 0.0 |
| 220 - 239 | 0.0 |
| 240 - 259 | 1.6% |
| 260 - 279 | 0.0 |
| 280 - 299 | 0.0 |
| > 299 | 0.0 |
| min size (mm) | 27 |
| max size (mm) | 252 |
| mean | 63 |
| mode | 50 |

Pycnopodia helianthoides

| | |
|---|---|
| (cases) N= | 50 |
| < 20 | 0.0 |
| 20 - 39 | 0.0 |
| 40 - 59 | 2.0% |
| 60 - 79 | 12.0% |
| 80 - 99 | 36.0% |
| 100 - 119 | 16.0% |
| 120 - 139 | 10.0% |
| 140 - 159 | 4.0% |
| 160 - 179 | 0.0 |
| 180 - 199 | 10.0% |
| 200 - 219 | 2.0% |
| 220 - 239 | 2.0% |
| 240 - 259 | 2.0% |
| 260 - 279 | 0.0 |
| 280 - 299 | 0.0 |
| > 299 | 2.0% |
| min size (mm) | 42 |
| max size (mm) | 310 |
| mean | 123 |
| mode | 84 |

Parastichopus parvimensis

| | |
|---|---|
| (cases) N= | 34 |
| < 5 | 0.0 |
| 5 - 6 | 0.0 |
| 7 - 8 | 0.0 |
| 9 - 10 | 2.9% |
| 11 - 12 | 8.8% |
| 13 - 14 | 44.1% |
| 15 - 16 | 29.4% |
| 17 - 18 | 11.8% |
| 19 - 20 | 0.0 |
| 21 - 22 | 2.9% |
| > 22 | 0.0 |
| min size (cm) | 10 |
| max size (cm) | 21 |
| mean | 14 |
| mode | 14 |

Strongylocentrotus franciscanus

| | |
|---|---|
| (cases) N= | 106 |
| < 5 | 0.0 |
| 5 - 9 | 0.0 |
| 10 - 14 | 0.9% |
| 15 - 19 | 4.7% |
| 20 - 24 | 4.7% |
| 25 - 29 | 7.5% |
| 30 - 34 | 6.6% |
| 35 - 39 | 8.5% |
| 40 - 44 | 6.6% |
| 45 - 49 | 6.6% |
| 50 - 54 | 4.7% |
| 55 - 59 | 3.8% |
| 60 - 64 | 7.5% |
| 65 - 69 | 2.8% |
| 70 - 74 | 10.4% |
| 75 - 79 | 1.9% |
| 80 - 84 | 6.6% |
| 85 - 90 | 7.5% |
| 90 - 94 | 2.8% |
| 95 - 99 | 2.8% |
| 100 - 104 | 0.9% |
| 105 - 109 | 0.9% |
| > 109 | 0.9% |
| min size (mm) | 12 |
| max size (mm) | 118 |
| mean | 56 |
| mode | 36 |

Strongylocentrotus purpuratus

| | |
|---|---|
| (cases) N= | 127 |
| < 5 | 0.0 |
| 5 - 9 | 0.0 |
| 10 - 14 | 0.8% |
| 15 - 19 | 0.8% |
| 20 - 24 | 5.5% |
| 25 - 29 | 4.7% |
| 30 - 34 | 12.6% |
| 35 - 39 | 23.6% |
| 40 - 44 | 25.2% |
| 45 - 49 | 18.1% |
| 50 - 54 | 5.5% |
| 55 - 59 | 1.6% |
| 60 - 64 | 1.6% |
| 65 - 69 | 0.0 |
| 70 - 74 | 0.0 |
| 75 - 79 | 0.0 |
| 80 - 84 | 0.0 |
| 85 - 90 | 0.0 |
| 90 - 94 | 0.0 |
| 95 - 99 | 0.0 |
| 100 - 104 | 0.0 |
| 105 - 109 | 0.0 |
| > 109 | 0.0 |
| min size (mm) | 11 |
| max size (mm) | 62 |
| mean | 39 |
| mode | 37 |

# LOCATION 4 SANTA ROSA ISLAND - JOHNSON'S LEE SOUTH

Macrocystis pyrifera numbers of stipes.

| | |
|---|---|
| (cases) N= | 106 |
| < 3 | 2.8% |
| 3 - 5 | 3.8% |
| 6 - 8 | 12.3% |
| 9 - 11 | 17.9% |
| 12 - 14 | 17.0% |
| 15 - 17 | 17.9% |
| 18 - 20 | 11.3% |
| 21 - 23 | 8.5% |
| 24 - 26 | 3.8% |
| 27 - 29 | 3.8% |
| 30 - 32 | 0.0 |
| 33 - 35 | 0.9% |
| 36 - 38 | 0.0 |
| 39 - 41 | 0.0 |
| 42 - 44 | 0.0 |
| >44 | 0.0 |
| min number | 2 |
| max number | 35 |
| mean | 14 |
| mode | 11 |

Macrocystis pyrifera holdfast diameters.

| | |
|---|---|
| (cases) N= | 106 |
| < 6 | 0.0 |
| 6 - 11 | 0.0 |
| 12 - 17 | 1.9% |
| 18 - 23 | 4.7% |
| 24 - 29 | 6.6% |
| 30 - 35 | 13.2% |
| 36 - 41 | 14.2% |
| 42 - 47 | 25.5% |
| 48 - 53 | 14.2% |
| 54 - 59 | 13.2% |
| 60 - 65 | 6.6% |
| 66 - 71 | 0.0 |
| 72 - 77 | 0.0 |
| 78 - 83 | 0.0 |
| 84 - 89 | 0.0 |
| >89 | 0.0 |
| min width (cm) | 13 |
| max width (cm) | 64 |
| mean | 43 |
| mode | 45 |

Lophogorgia chilensis widths

| | |
|---|---|
| (cases) N= | 60 |
| < 5 | 0.0 |
| 5 - 8 | 5.0% |
| 9 - 12 | 3.3% |
| 13 - 16 | 16.7% |
| 17 - 20 | 10.0% |
| 21 - 24 | 11.7% |
| 25 - 28 | 21.7% |
| 29 - 32 | 18.3% |
| 33 - 36 | 10.0% |
| 37 - 40 | 3.3% |
| 41 - 44 | 0.0 |
| 45 - 48 | 0.0 |
| 49 - 52 | 0.0 |
| >53 | 0.0 |
| min width (cm) | 6 |
| max width (cm) | 38 |
| mean | 24 |
| mode | 27 |

Lophogorgia chilensis heights

| | |
|---|---|
| (cases) N= | 60 |
| < 5 | 0.0 |
| 5 - 8 | 1.7% |
| 9 - 12 | 1.7% |
| 13 - 16 | 0.0 |
| 17 - 20 | 13.3% |
| 21 - 24 | 15.0% |
| 25 - 28 | 31.7% |
| 29 - 32 | 20.0% |
| 33 - 36 | 10.0% |
| 37 - 40 | 3.3% |
| 41 - 44 | 3.3% |
| 45 - 48 | 0.0 |
| 49 - 52 | 0.0 |
| >53 | 0.0 |
| min height (cm) | 8 |
| max height (cm) | 44 |
| mean | 27 |
| mode | 26 |

LOCATION 5 SANTA ROSA ISLAND - RODES REEF

1990 QUADRAT DATA: MEAN NUMBER PER $M^2$

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Macrocystis pyrifera adult | 0.1500 | 0.2351 | 20 |
| Eisenia arborea | 0.0000 | 0.0000 | 20 |
| Pterygophora californica | 0.0000 | 0.0000 | 20 |
| Laminaria farlowii | 0.0000 | 0.0000 | 20 |
| Macrocystis pyrifera juvenile | 2.2000 | 6.3957 | 20 |
| Macrocystis pyrifera all | 2.3500 | 6.3497 | 20 |
| Cypraea spadicea | 0.1000 | 0.3479 | 20 |
| Astraea undosa | 0.0000 | 0.0000 | 20 |
| Astraea gibberosa | 0.0250 | 0.1118 | 20 |
| Patiria miniata | 1.9250 | 1.1387 | 20 |
| Pisaster giganteus | 0.3500 | 0.5643 | 20 |
| Strongylocentrotus franciscanus | 6.9250 | 8.5182 | 20 |
| Strongylocentrotus purpuratus | 1.2500 | 2.9222 | 20 |
| Parastichopus parvimensis | 0.0250 | 0.1118 | 20 |
| Styela monteryensis | 0.1250 | 0.3193 | 20 |
| Lythrypnus dalli | 0.0000 | 0.0000 | 20 |
| Coryphopterus nicholsii | 0.0250 | 0.1118 | 20 |
| Alloclinus holderi | 0.0250 | 0.1118 | 20 |

1990 BAND TRANSECT DATA: MEAN NUMBER PER $M^2$

| | | | |
|---|---|---|---|
| Tethya aurantia | 0.1361 | 0.0855 | 12 |
| Allopora californica | 0.0000 | 0.0000 | 12 |
| Tealia lofotensis | 0.0417 | 0.0306 | 12 |
| Lophogorgia chilensis | 0.0000 | 0.0000 | 12 |
| Muricea fruticosa | 0.0000 | 0.0000 | 12 |
| Muricea californica | 0.0000 | 0.0000 | 12 |
| Panulirus interruptus | 0.0000 | 0.0000 | 12 |
| Haliotis rufescens | 0.0000 | 0.0000 | 12 |
| Haliotis corrugata | 0.0000 | 0.0000 | 12 |
| Haliotis fulgens | 0.0000 | 0.0000 | 12 |
| Kelletia kelletii | 0.0028 | 0.0065 | 12 |
| Megathura crenulata | 0.0097 | 0.0086 | 12 |
| Hinnites giganteus | 0.0042 | 0.0104 | 12 |
| Aplysia californica | 0.0000 | 0.0000 | 12 |
| Pycnopodia helianthoides | 0.1125 | 0.0689 | 12 |
| Lytechinus anamesus | 0.0000 | 0.0000 | 12 |

LOCATION 5 SANTA ROSA ISLAND - RODES REEF
1990 RANDOM POINT CONTACT DATA: MEAN PERCENT COVER

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Green algae | 0.0000 | 0.0000 | 25 |
| Miscellaneous brown algae | 0.2000 | 0.6922 | 25 |
| Desmarestia spp. | 0.1000 | 0.5000 | 25 |
| Laminaria farlowii | 0.0000 | 0.0000 | 25 |
| Cystoseira spp. | 0.0000 | 0.0000 | 25 |
| Macrocystis, Eisenia, Pterygophora | 6.0000 | 10.3078 | 25 |
| Miscellaneous red algae | 15.7000 | 20.0588 | 25 |
| Articulated coralline algae | 0.7000 | 1.1456 | 25 |
| Crustose coralline algae | 15.9000 | 10.5297 | 25 |
| Gelidium spp. | 0.0000 | 0.0000 | 25 |
| Gigartina spp. | 0.0000 | 0.0000 | 25 |
| Miscellaneous plants | 4.7000 | 5.6972 | 25 |
| Sponges | 1.2000 | 1.7854 | 25 |
| Corynactis californica | 0.3000 | 0.8292 | 25 |
| Balanophyllia elegans | 6.6000 | 4.3229 | 25 |
| Astrangia lajollaensis | 10.0000 | 10.0519 | 25 |
| Diopatra ornata | 4.5000 | 6.8845 | 25 |
| Phragmatopoma californica | 3.5000 | 6.1237 | 25 |
| Serpulorbis squamigerus | 0.0000 | 0.0000 | 25 |
| Bryozoans, other | 11.8000 | 12.6351 | 25 |
| Diaperoecia californica | 6.2000 | 6.9267 | 25 |
| Tunicates | 3.4000 | 3.2977 | 25 |
| Miscellaneous invertebrates | 12.1000 | 10.5987 | 25 |
| Bare substrate | 5.9000 | 8.5355 | 25 |
| Rock | 84.1000 | 19.7758 | 25 |
| Cobble | 6.1000 | 6.9252 | 25 |
| Sand | 9.8000 | 15.3080 | 25 |

1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| | | | |
|---|---|---|---|
| TOTAL FISH ABUNDANCE | 4.5000 | 7.2228 | 96 |
| Chromis punctipinnis | 13.5000 | 11.2758 | 8 |
| Oxyjulis californica | 10.5000 | 17.4274 | 8 |
| Sebastes mystinus | 6.5000 | 3.8545 | 8 |
| Sebastes serranoides | 3.7500 | 3.7702 | 8 |
| Sebastes atrovirens | 6.2500 | 1.6690 | 8 |
| Paralabrax clathratus | 0.8750 | 1.2464 | 8 |
| Semicossyphus pulcher | 5.3750 | 2.5036 | 8 |
| Embiotoca jacksoni | 2.1250 | 1.1260 | 8 |
| Embiotoca lateralis | 4.7500 | 2.3146 | 8 |
| Damalichthys vacca | 0.3750 | 0.5175 | 8 |
| Hypsypops rubicundus | 0.0000 | 0.0000 | 8 |
| Girella nigricans | 0.0000 | 0.0000 | 8 |

LOCATION 5 SANTA ROSA ISLAND - RODES REEF
1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| Species | Date (year/month/day) | Mean | Std Dev | Cases |
|---|---|---|---|---|
| Chromis punctipinnis adult | | 12.6250 | 11.9515 | 8 |
| | 900709 | 20.5000 | 11.9583 | 4 |
| | 900924 | 4.7500 | 4.9917 | 4 |
| Chromis punctipinnis juvenile | | 0.8750 | 2.1002 | 8 |
| | 900709 | 0.0000 | 0.0000 | 4 |
| | 900924 | 1.7500 | 2.8723 | 4 |
| Oxyjulis californica adult | | 10.5000 | 17.4274 | 8 |
| | 900709 | 20.5000 | 21.0000 | 4 |
| | 900924 | 0.5000 | 1.0000 | 4 |
| Oxyjulis californica juvenile | | 0.0000 | 0.0000 | 8 |
| | 900709 | 0.0000 | 0.0000 | 4 |
| | 900924 | 0.0000 | 0.0000 | 4 |
| Sebastes mystinus adult | | 5.0000 | 4.5356 | 8 |
| | 900709 | 8.5000 | 3.7859 | 4 |
| | 900924 | 1.5000 | 1.0000 | 4 |
| Sebastes mystinus juvenile | | 1.5000 | 1.9272 | 8 |
| | 900709 | 0.7500 | 1.5000 | 4 |
| | 900924 | 2.2500 | 2.2174 | 4 |
| Sebastes serranoides adult | | 3.7500 | 3.7702 | 8 |
| | 900709 | 7.0000 | 2.1602 | 4 |
| | 900924 | 0.5000 | 0.5774 | 4 |

| | | | |
|---|---|---|---|
| Sebastes serranoides juvenile | | 0.0000 | 0.0000 |
| 8 | | | |
| | 900709 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900924 | 0.0000 | 0.0000 |
| 4 | | | |
| Sebastes atrovirens adult | | 5.3750 | 1.9955 |
| 8 | | | |
| | 900709 | 6.7500 | 0.9574 |
| 4 | | | |
| | 900924 | 4.0000 | 1.8257 |
| 4 | | | |
| Sebastes atrovirens juvenile | | 0.8750 | 1.2464 |
| 8 | | | |
| | 900709 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900924 | 1.7500 | 1.2583 |
| 4 | | | |
| Paralabrax clathratus adult | | 0.8750 | 1.2464 |
| 8 | | | |
| | 900709 | 1.7500 | 1.2583 |
| 4 | | | |
| | 900924 | 0.0000 | 0.0000 |
| 4 | | | |

LOCATION 5 SANTA ROSA ISLAND - RODES REEF

| | | | |
|---|---|---|---|
| Paralabrax clathratus juvenile | | 0.0000 | 0.0000 |
| 8 | | | |
| | 900709 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900924 | 0.0000 | 0.0000 |
| 4 | | | |
| Semicossyphus pulcher male | | 1.2500 | 0.7071 |
| 8 | | | |
| | 900709 | 1.2500 | 0.9574 |
| 4 | | | |
| | 900924 | 1.2500 | 0.5000 |
| 4 | | | |
| Semicossyphus pulcher female | | 4.1250 | 2.5319 |
| 8 | | | |
| | 900709 | 3.7500 | 2.2174 |
| 4 | | | |
| | 900924 | 4.5000 | 3.1091 |
| 4 | | | |
| Embiotoca jacksoni adult | | 2.0000 | 1.0690 |
| 8 | | | |
| | 900709 | 1.5000 | 1.2910 |
| 4 | | | |
| | 900924 | 2.5000 | 0.5774 |
| 4 | | | |
| Embiotoca jacksoni juvenile | | 0.1250 | 0.3536 |
| 8 | | | |
| | 900709 | 0.2500 | 0.5000 |
| 4 | | | |
| | 900924 | 0.0000 | 0.0000 |
| 4 | | | |
| Embiotoca lateralis adult | | 4.2500 | 2.3146 |
| 8 | | | |
| | 900709 | 2.5000 | 1.0000 |
| 4 | | | |
| | 900924 | 6.0000 | 1.8257 |
| 4 | | | |
| Embiotoca lateralis juvenile | | 0.5000 | 1.0690 |
| 8 | | | |
| | 900709 | 0.7500 | 1.5000 |
| 4 | | | |
| | 900924 | 0.2500 | 0.5000 |
| 4 | | | |
| Damalichthys vacca adult | | 0.3750 | 0.5175 |
| 8 | | | |
| | 900709 | 0.5000 | 0.5774 |
| 4 | | | |

| | | | |
|---|---|---|---|
| | 900924 | 0.2500 | 0.5000 |
| 4 | | | |
| Damalichthys vacca juvenile | | 0.0000 | 0.0000 |
| 8 | | | |
| | 900709 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900924 | 0.0000 | 0.0000 |
| 4 | | | |
| Hypsypops rubicundus adult | | 0.0000 | 0.0000 |
| 8 | | | |
| | 900709 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900924 | 0.0000 | 0.0000 |
| 4 | | | |
| Hypsypops rubicundus juvenile | | 0.0000 | 0.0000 |
| 8 | | | |
| | 900709 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900924 | 0.0000 | 0.0000 |
| 4 | | | |
| Girella nigricans adult | | 0.0000 | 0.0000 |
| 8 | | | |
| | 900709 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900924 | 0.0000 | 0.0000 |
| 4 | | | |
| Girella nigricans juvenile | | 0.0000 | 0.0000 |
| 8 | | | |
| | 900709 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900924 | 0.0000 | 0.0000 |
| 4 | | | |

LOCATION 5 SANTA ROSA ISLAND - RODES REEF
1990 SIZE FREQUENCY DISTRIBUTIONS

Tethya aurantia

| | |
|---|---|
| (cases) N= | 35 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 8.6% |
| 30 - 39 | 8.6% |
| 40 - 49 | 14.3% |
| 50 - 59 | 17.1% |
| 60 - 69 | 17.1% |
| 70 - 79 | 20.0% |
| 80 - 89 | 2.9% |
| 90 - 99 | 11.4% |
| > 99 | 0.0 |
| min size (mm) | 24 |
| max size (mm) | 94 |
| mean | 61 |
| mode | 58 |

Patiria miniata

| | |
|---|---|
| (cases) N= | 53 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 9.4% |
| 30 - 39 | 22.6% |
| 40 - 49 | 11.3% |
| 50 - 59 | 22.6% |
| 60 - 69 | 13.2% |
| 70 - 79 | 13.2% |
| 80 - 89 | 5.7% |
| 90 - 99 | 1.9% |
| > 99 | 0.0 |
| min size (mm) | 21 |
| max size (mm) | 95 |
| mean | 52 |
| mode | 32 |

Pisaster giganteus

| | |
|---|---|
| (cases) N= | 50 |
| < 20 | 0.0 |
| 20 - 39 | 10.0% |
| 40 - 59 | 32.0% |
| 60 - 79 | 46.0% |
| 80 - 99 | 10.0% |
| 100 - 119 | 0.0 |
| 120 - 139 | 0.0 |
| 140 - 159 | 2.0% |
| 160 - 179 | 0.0 |
| 180 - 199 | 0.0 |
| 200 - 219 | 0.0 |
| 220 - 239 | 0.0 |
| 240 - 259 | 0.0 |
| 260 - 279 | 0.0 |
| 280 - 299 | 0.0 |
| > 299 | 0.0 |
| min size (mm) | 22 |
| max size (mm) | 143 |
| mean | 63 |
| mode | 54 |

Pycnopodia helianthoides

| | |
|---|---|
| (cases) N= | 49 |
| < 20 | 0.0 |
| 20 - 39 | 2.0% |
| 40 - 59 | 6.1% |
| 60 - 79 | 36.7% |
| 80 - 99 | 14.3% |
| 100 - 119 | 8.2% |
| 120 - 139 | 12.2% |
| 140 - 159 | 12.2% |
| 160 - 179 | 0.0 |
| 180 - 199 | 0.0 |
| 200 - 219 | 6.1% |
| 220 - 239 | 2.0% |
| 240 - 259 | 0.0 |
| 260 - 279 | 0.0 |
| 280 - 299 | 0.0 |
| > 299 | 0.0 |
| min size (mm) | 38 |
| max size (mm) | 225 |
| mean | 104 |
| mode | 67 |

# LOCATION 5 SANTA ROSA ISLAND - RODES REEF

Strongylocentrotus franciscanus

| | |
|---|---|
| (cases) N= | 130 |
| < 5 | 0.0 |
| 5 - 9 | 0.0 |
| 10 - 14 | 0.0 |
| 15 - 19 | 0.8% |
| 20 - 24 | 0.0 |
| 25 - 29 | 0.8% |
| 30 - 34 | 2.3% |
| 35 - 39 | 4.6% |
| 40 - 44 | 6.9% |
| 45 - 49 | 3.8% |
| 50 - 54 | 5.4% |
| 55 - 59 | 3.8% |
| 60 - 64 | 7.7% |
| 65 - 69 | 6.9% |
| 70 - 74 | 9.2% |
| 75 - 79 | 22.3% |
| 80 - 84 | 17.7% |
| 85 - 90 | 5.4% |
| 90 - 94 | 2.3% |
| 95 - 99 | 0.0 |
| 100 - 104 | 0.0 |
| 105 - 109 | 0.0 |
| > 109 | 0.0 |
| min size (mm) | 16 |
| max size (mm) | 92 |
| mean | 67 |
| mode | 78 |

Strongylocentrotus purpuratus

| | |
|---|---|
| (cases) N= | 132 |
| < 5 | 0.0 |
| 5 - 9 | 0.0 |
| 10 - 14 | 0.0 |
| 15 - 19 | 3.8% |
| 20 - 24 | 7.6% |
| 25 - 29 | 7.6% |
| 30 - 34 | 10.6% |
| 35 - 39 | 15.2% |
| 40 - 44 | 17.4% |
| 45 - 49 | 18.2% |
| 50 - 54 | 11.4% |
| 55 - 59 | 6.8% |
| 60 - 64 | 0.8% |
| 65 - 69 | 0.8% |
| 70 - 74 | 0.0 |
| 75 - 79 | 0.0 |
| 80 - 84 | 0.0 |
| 85 - 90 | 0.0 |
| 90 - 94 | 0.0 |
| 95 - 99 | 0.0 |
| 100 - 104 | 0.0 |
| 105 - 109 | 0.0 |
| > 109 | 0.0 |
| min size (mm) | 16 |
| max size (mm) | 65 |
| mean | 40 |
| mode | 39 |

Macrocystis pyrifera numbers of stipes.

| | |
|---|---|
| (cases) N= | 98 |
| < 3 | 0.0 |
| 3 - 5 | 4.1% |
| 6 - 8 | 7.1% |
| 9 - 11 | 8.2% |
| 12 - 14 | 9.2% |
| 15 - 17 | 11.2% |
| 18 - 20 | 16.3% |
| 21 - 23 | 9.2% |
| 24 - 26 | 15.3% |
| 27 - 29 | 6.1% |
| 30 - 32 | 1.0% |
| 33 - 35 | 3.1% |
| 36 - 38 | 2.0% |
| 39 - 41 | 3.1% |
| 42 - 44 | 1.0% |
| >44 | 2.0% |
| min number | 3 |
| max number | 53 |
| mean | 20 |
| mode | 18 |

Macrocystis pyrifera holdfast diameters.

| | |
|---|---|
| (cases) N= | 98 |
| < 6 | 0.0 |
| 6 - 11 | 0.0 |
| 12 - 17 | 3.1% |
| 18 - 23 | 6.1% |
| 24 - 29 | 17.3% |
| 30 - 35 | 20.4% |
| 36 - 41 | 21.4% |
| 42 - 47 | 17.3% |
| 48 - 53 | 13.3% |
| 54 - 59 | 0.0 |
| 60 - 65 | 1.0% |
| 66 - 71 | 0.0 |
| 72 - 77 | 0.0 |
| 78 - 83 | 0.0 |
| 84 - 89 | 0.0 |
| >89 | 0.0 |
| min width (cm) | 12 |
| max width (cm) | 62 |
| mean | 36 |
| mode | 36 |

1990 QUADRAT DATA: MEAN NUMBER PER $M^2$

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Macrocystis pyrifera adult | 0.3750 | 0.6664 | 20 |
| Eisenia arborea | 0.2500 | 0.8959 | 20 |
| Pterygophora californica | 0.1250 | 0.4552 | 20 |
| Laminaria farlowii | 0.1500 | 0.2856 | 20 |
| Macrocystis pyrifera juvenile | 2.1750 | 3.0100 | 20 |
| Macrocystis pyrifera all | 2.5500 | 3.3043 | 20 |
| Cypraea spadicea | 0.6000 | 1.1192 | 20 |
| Astraea undosa | 0.0000 | 0.0000 | 20 |
| Patiria miniata | 1.2000 | 1.1630 | 20 |
| Pisaster giganteus | 0.4750 | 0.3796 | 20 |
| Strongylocentrotus franciscanus | 2.4500 | 2.5438 | 20 |
| Strongylocentrotus purpuratus | 39.9500 | 39.0273 | 20 |
| Parastichopus parvimensis | 1.7250 | 0.9101 | 20 |
| Styela monteryensis | 0.0000 | 0.0000 | 20 |
| Lythrypnus dalli | 0.0000 | 0.0000 | 20 |
| Coryphopterus nicholsii | 1.2750 | 1.3521 | 20 |
| Alloclinus holderi | 0.4000 | 0.6198 | 20 |

1990 BAND TRANSECT DATA: MEAN NUMBER PER $M^2$

| | | | |
|---|---|---|---|
| Tethya aurantia | 0.0097 | 0.0111 | 12 |
| Allopora californica | 0.0139 | 0.0199 | 12 |
| Tealia lofotensis | 0.0014 | 0.0048 | 12 |
| Lophogorgia chilensis | 0.0694 | 0.0465 | 12 |
| Muricea fruticosa | 0.0000 | 0.0000 | 12 |
| Panulirus interruptus | 0.0000 | 0.0000 | 12 |
| Haliotis rufescens | 0.0000 | 0.0000 | 12 |
| Haliotis corrugata | 0.0000 | 0.0000 | 12 |
| Haliotis fulgens | 0.0000 | 0.0000 | 12 |
| Kelletia kelletii | 0.0528 | 0.0324 | 12 |
| Megathura crenulata | 0.1319 | 0.0657 | 12 |
| Hinnites giganteus | 0.0153 | 0.0166 | 12 |
| Aplysia californica | 0.0125 | 0.0247 | 12 |
| Pycnopodia helianthoides | 0.0153 | 0.0132 | 12 |
| Lytechinus anamesus | 0.6417 | 1.1969 | 12 |

LOCATION 6 SANTA CRUZ ISLAND - GULL ISLAND SOUTH
1990 RANDOM POINT CONTACT DATA: MEAN PERCENT COVER

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Green algae | 2.5000 | 4.2081 | 25 |
| Miscellaneous brown algae | 1.3000 | 3.1557 | 25 |
| Desmarestia spp. | 0.0000 | 0.0000 | 25 |
| Laminaria farlowii | 0.2000 | 1.0000 | 25 |
| Cystoseira spp. | 0.0000 | 0.0000 | 25 |
| Macrocystis, Eisenia, Pterygophora | 19.6000 | 29.5864 | 25 |
| Miscellaneous red algae | 16.8000 | 14.6401 | 25 |
| Articulated coralline algae | 1.4000 | 3.1524 | 25 |
| Crustose coralline algae | 46.8000 | 16.1135 | 25 |
| Gelidium spp. | 0.0000 | 0.0000 | 25 |
| Gigartina spp. | 0.0000 | 0.0000 | 25 |
| Miscellaneous plants | 7.5000 | 8.8093 | 25 |
| Sponges | 0.4000 | 1.1815 | 25 |
| Corynactis californica | 7.4000 | 8.2120 | 25 |
| Balanophyllia elegans | 10.1000 | 10.7160 | 25 |
| Astrangia lajollaensis | 1.4000 | 2.1747 | 25 |
| Diopatra ornata | 0.3000 | 0.8292 | 25 |
| Phragmatopoma californica | 0.0000 | 0.0000 | 25 |
| Serpulorbis squamigerus | 0.1000 | 0.5000 | 25 |
| Bryozoans, other | 2.2000 | 3.3323 | 25 |
| Diaperoecia californica | 2.8000 | 3.4095 | 25 |
| Tunicates | 0.3000 | 0.8292 | 25 |
| Miscellaneous invertebrates | 8.2000 | 7.3428 | 25 |
| Bare substrate | 10.1000 | 8.7939 | 25 |
| Rock | 93.0000 | 11.8585 | 25 |
| Cobble | 2.4000 | 3.9843 | 25 |
| Sand | 4.6000 | 9.0046 | 25 |

1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| | | | |
|---|---|---|---|
| TOTAL FISH ABUNDANCE | 2.4688 | 6.7511 | 96 |
| Chromis punctipinnis | 4.7500 | 6.3189 | 8 |
| Oxyjulis californica | 3.6250 | 3.8891 | 8 |
| Sebastes mystinus | 16.3750 | 16.7497 | 8 |
| Sebastes serranoides | 1.2500 | 2.7646 | 8 |
| Sebastes atrovirens | 0.1250 | 0.3536 | 8 |
| Paralabrax clathratus | 1.1250 | 1.3562 | 8 |
| Semicossyphus pulcher | 1.2500 | 1.6690 | 8 |
| Embiotoca jacksoni | 0.1250 | 0.3536 | 8 |
| Embiotoca lateralis | 0.0000 | 0.0000 | 8 |
| Damalichthys vacca | 0.7500 | 0.8864 | 8 |
| Hypsypops rubicundus | 0.2500 | 0.4629 | 8 |
| Girella nigricans | 0.0000 | 0.0000 | 8 |

LOCATION 6 SANTA CRUZ ISLAND - GULL ISLAND SOUTH
1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| Species | Date (year/month/day) | Mean | Std Dev | Cases |
|---|---|---|---|---|
| Chromis punctipinnis adult | | 2.7500 | 3.0589 | 8 |
| | 900809 | 1.7500 | 2.2174 | 4 |
| | 900912 | 3.7500 | 3.7749 | 4 |
| Chromis punctipinnis juvenile | | 2.0000 | 5.2644 | 8 |
| | 900809 | 0.0000 | 0.0000 | 4 |
| | 900912 | 4.0000 | 7.3485 | 4 |
| Oxyjulis californica adult | | 3.6250 | 3.8891 | 8 |
| | 900809 | 4.5000 | 5.7446 | 4 |
| | 900912 | 2.7500 | 0.5000 | 4 |
| Oxyjulis californica juvenile | | 0.0000 | 0.0000 | 8 |
| | 900809 | 0.0000 | 0.0000 | 4 |
| | 900912 | 0.0000 | 0.0000 | 4 |
| Sebastes mystinus adult | | 1.0000 | 1.1952 | 8 |
| | 900809 | 0.7500 | 1.5000 | 4 |
| | 900912 | 1.2500 | 0.9574 | 4 |
| Sebastes mystinus juvenile | | 15.3750 | 16.6557 | 8 |
| | 900809 | 5.0000 | 3.6515 | 4 |
| | 900912 | 25.7500 | 18.6257 | 4 |
| Sebastes serranoides adult | | 1.1250 | 2.7999 | 8 |
| | 900809 | 0.0000 | 0.0000 | 4 |
| | 900912 | 2.2500 | 3.8622 | 4 |

| | | | |
|---|---|---|---|
| Sebastes serranoides juvenile | | 0.1250 | 0.3536 |
| 8 | | | |
| | 900809 | 0.2500 | 0.5000 |
| 4 | | | |
| | 900912 | 0.0000 | 0.0000 |
| 4 | | | |
| Sebastes atrovirens adult | | 0.1250 | 0.3536 |
| 8 | | | |
| | 900809 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900912 | 0.2500 | 0.5000 |
| 4 | | | |
| Sebastes atrovirens juvenile | | 0.0000 | 0.0000 |
| 8 | | | |
| | 900809 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900912 | 0.0000 | 0.0000 |
| 4 | | | |
| Paralabrax clathratus adult | | 1.1250 | 1.3562 |
| 8 | | | |
| | 900809 | 0.2500 | 0.5000 |
| 4 | | | |
| | 900912 | 2.0000 | 1.4142 |
| 4 | | | |

| | | | |
|---|---|---|---|
| Paralabrax clathratus juvenile | | 0.0000 | 0.0000 |
| 8 | | | |
| | 900809 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900912 | 0.0000 | 0.0000 |
| 4 | | | |
| Semicossyphus pulcher male | | 0.6250 | 0.9161 |
| 8 | | | |
| | 900809 | 0.5000 | 1.0000 |
| 4 | | | |
| | 900912 | 0.7500 | 0.9574 |
| 4 | | | |
| Semicossyphus pulcher female | | 0.6250 | 1.0607 |
| 8 | | | |
| | 900809 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900912 | 1.2500 | 1.2583 |
| 4 | | | |
| Embiotoca jacksoni adult | | 0.1250 | 0.3536 |
| 8 | | | |
| | 900809 | 0.2500 | 0.5000 |
| 4 | | | |
| | 900912 | 0.0000 | 0.0000 |
| 4 | | | |
| Embiotoca jacksoni juvenile | | 0.0000 | 0.0000 |
| 8 | | | |
| | 900809 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900912 | 0.0000 | 0.0000 |
| 4 | | | |
| Embiotoca lateralis adult | | 0.0000 | 0.0000 |
| 8 | | | |
| | 900809 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900912 | 0.0000 | 0.0000 |
| 4 | | | |
| Embiotoca lateralis juvenile | | 0.0000 | 0.0000 |
| 8 | | | |
| | 900809 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900912 | 0.0000 | 0.0000 |
| 4 | | | |
| Damalichthys vacca adult | | 0.7500 | 0.8864 |
| 8 | | | |
| | 900809 | 1.2500 | 0.9574 |
| 4 | | | |

| | | | |
|---|---|---|---|
| | 900912 | 0.2500 | 0.5000 |
| 4 | | | |
| Damalichthys vacca juvenile | | 0.0000 | 0.0000 |
| 8 | | | |
| | 900809 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900912 | 0.0000 | 0.0000 |
| 4 | | | |
| Hypsypops rubicundus adult | | 0.2500 | 0.4629 |
| 8 | | | |
| | 900809 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900912 | 0.5000 | 0.5774 |
| 4 | | | |
| Hypsypops rubicundus juvenile | | 0.0000 | 0.0000 |
| 8 | | | |
| | 900809 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900912 | 0.0000 | 0.0000 |
| 4 | | | |
| Girella nigricans adult | | 0.0000 | 0.0000 |
| 8 | | | |
| | 900809 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900912 | 0.0000 | 0.0000 |
| 4 | | | |
| Girella nigricans juvenile | | 0.0000 | 0.0000 |
| 8 | | | |
| | 900809 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900912 | 0.0000 | 0.0000 |
| 4 | | | |

# LOCATION 6 SANTA CRUZ ISLAND - GULL ISLAND SOUTH
# 1990 SIZE FREQUENCY DISTRIBUTIONS

## Cypraea spadicea

| | |
|---|---|
| (cases) N= | 26 |
| < 30 | 0.0 |
| 30 - 34 | 0.0 |
| 35 - 39 | 11.5% |
| 40 - 44 | 15.4% |
| 45 - 49 | 50.0% |
| 50 - 54 | 23.1% |
| 55 - 59 | 0.0 |
| > 59 | 0.0 |
| min size (mm) | 36 |
| max size (mm) | 53 |
| mean | 46 |
| mode | 45 |

## Kelletia kelletii

| | |
|---|---|
| (cases) N= | 22 |
| < 40 | 0.0 |
| 40 - 49 | 0.0 |
| 50 - 59 | 0.0 |
| 60 - 69 | 0.0 |
| 70 - 79 | 9.1% |
| 80 - 89 | 18.2% |
| 90 - 99 | 40.9% |
| 100 - 109 | 22.7% |
| 110 - 119 | 9.1% |
| 120 - 129 | 0.0 |
| 130 - 139 | 0.0 |
| 140 - 149 | 0.0 |
| > 149 | 0.0 |
| min size (mm) | 73 |
| max size (mm) | 115 |
| mean | 93 |
| mode | 73 |

## Megathura crenulata

| | |
|---|---|
| (cases) N= | 37 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 0.0 |
| 30 - 39 | 0.0 |
| 40 - 49 | 2.7% |
| 50 - 59 | 5.4% |
| 60 - 69 | 32.4% |
| 70 - 79 | 37.8% |
| 80 - 89 | 10.8% |
| 90 - 99 | 10.8% |
| 100 - 109 | 0.0 |
| 110 - 119 | 0.0 |
| > 119 | 0.0 |
| min size (mm) | 49 |
| max size (mm) | 97 |
| mean | 73 |
| mode | 69 |

## Patiria miniata

| | |
|---|---|
| (cases) N= | 49 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 2.0% |
| 30 - 39 | 16.3% |
| 40 - 49 | 10.2% |
| 50 - 59 | 22.4% |
| 60 - 69 | 16.3% |
| 70 - 79 | 14.3% |
| 80 - 89 | 12.2% |
| 90 - 99 | 4.1% |
| > 99 | 2.0% |
| min size (mm) | 27 |
| max size (mm) | 107 |
| mean | 60 |
| mode | 59 |

Pisaster giganteus

| | |
|---|---|
| (cases) N= | 52 |
| < 20 | 0.0 |
| 20 - 39 | 0.0 |
| 40 - 59 | 1.9% |
| 60 - 79 | 7.7% |
| 80 - 99 | 55.8% |
| 100 - 119 | 26.9% |
| 120 - 139 | 0.0 |
| 140 - 159 | 0.0 |
| 160 - 179 | 5.8% |
| 180 - 199 | 0.0 |
| 200 - 219 | 1.9% |
| 220 - 239 | 0.0 |
| 240 - 259 | 0.0 |
| 260 - 279 | 0.0 |
| 280 - 299 | 0.0 |
| > 299 | 0.0 |
| min size (mm) | 45 |
| max size (mm) | 212 |
| mean | 101 |
| mode | 90 |

Pycnopodia helianthoides

| | |
|---|---|
| (cases) N= | 13 |
| < 20 | 0.0 |
| 20 - 39 | 0.0 |
| 40 - 59 | 0.0 |
| 60 - 79 | 0.0 |
| 80 - 99 | 0.0 |
| 100 - 119 | 0.0 |
| 120 - 139 | 0.0 |
| 140 - 159 | 0.0 |
| 160 - 179 | 0.0 |
| 180 - 199 | 0.0 |
| 200 - 219 | 30.8% |
| 220 - 239 | 23.1% |
| 240 - 259 | 30.8% |
| 260 - 279 | 0.0 |
| 280 - 299 | 0.0 |
| > 299 | 7.7% |
| min size (mm) | 200 |
| max size (mm) | 310 |
| mean | 238 |
| mode | 200 |

Lytechinus anamesus

| | |
|---|---|
| (cases) N= | 154 |
| < 5 | 0.0 |
| 5 - 9 | 0.0 |
| 10 - 14 | 0.0 |
| 15 - 19 | 13.0% |
| 20 - 24 | 66.9% |
| 25 - 29 | 18.8% |
| 30 - 34 | 1.3% |
| 35 - 39 | 0.0 |
| 40 - 44 | 0.0 |
| 45 - 49 | 0.0 |
| > 49 | 0.0 |
| min size (mm) | 16 |
| max size (mm) | 30 |
| mean | 23 |
| mode | 22 |

Parastichopus parvimensis

| | |
|---|---|
| (cases) N= | 72 |
| < 5 | 0.0 |
| 5 - 6 | 0.0 |
| 7 - 8 | 4.2% |
| 9 - 10 | 15.3% |
| 11 - 12 | 36.1% |
| 13 - 14 | 30.6% |
| 15 - 16 | 11.1% |
| 17 - 18 | 2.8% |
| 19 - 20 | 0.0 |
| 21 - 22 | 0.0 |
| > 22 | 0.0 |
| min size (cm) | 7 |
| max size (cm) | 17 |
| mean | 12 |
| mode | 11 |

# LOCATION 6 SANTA CRUZ ISLAND - GULL ISLAND SOUTH

Strongylocentrotus purpuratus

| | |
|---|---|
| (cases) N= | 143 |
| < 5 | 0.0 |
| 5 - 9 | 1.4% |
| 10 - 14 | 6.3% |
| 15 - 19 | 35.7% |
| 20 - 24 | 43.4% |
| 25 - 29 | 13.3% |
| 30 - 34 | 0.0 |
| 35 - 39 | 0.0 |
| 40 - 44 | 0.0 |
| 45 - 49 | 0.0 |
| 50 - 54 | 0.0 |
| 55 - 59 | 0.0 |
| 60 - 64 | 0.0 |
| 65 - 69 | 0.0 |
| 70 - 74 | 0.0 |
| 75 - 79 | 0.0 |
| 80 - 84 | 0.0 |
| 85 - 90 | 0.0 |
| 90 - 94 | 0.0 |
| 95 - 99 | 0.0 |
| 100 - 104 | 0.0 |
| 105 - 109 | 0.0 |
| > 109 | 0.0 |
| min size (mm) | 6 |
| max size (mm) | 29 |
| mean | 20 |
| mode | 19 |

Strongylocentrotus franciscanus

| | |
|---|---|
| (cases) N= | 102 |
| < 5 | 0.0 |
| 5 - 9 | 0.0 |
| 10 - 14 | 0.0 |
| 15 - 19 | 7.8% |
| 20 - 24 | 10.8% |
| 25 - 29 | 20.6% |
| 30 - 34 | 28.4% |
| 35 - 39 | 17.6% |
| 40 - 44 | 9.8% |
| 45 - 49 | 1.0% |
| 50 - 54 | 1.0% |
| 55 - 59 | 1.0% |
| 60 - 64 | 0.0 |
| 65 - 69 | 2.0% |
| 70 - 74 | 0.0 |
| 75 - 79 | 0.0 |
| 80 - 84 | 0.0 |
| 85 - 90 | 0.0 |
| 90 - 94 | 0.0 |
| 95 - 99 | 0.0 |
| 100 - 104 | 0.0 |
| 105 - 109 | 0.0 |
| > 109 | 0.0 |
| min size (mm) | 15 |
| max size (mm) | 67 |
| mean | 32 |
| mode | 32 |

Macrocystis pyrifera numbers of stipes.

| | |
|---|---|
| (cases) N= | 99 |
| < 3 | 25.3% |
| 3 - 5 | 32.3% |
| 6 - 8 | 13.1% |
| 9 - 11 | 11.1% |
| 12 - 14 | 5.1% |
| 15 - 17 | 4.0% |
| 18 - 20 | 3.0% |
| 21 - 23 | 3.0% |
| 24 - 26 | 0.0 |
| 27 - 29 | 0.0 |
| 30 - 32 | 2.0% |
| 33 - 35 | 1.0% |
| 36 - 38 | 0.0 |
| 39 - 41 | 0.0 |
| 42 - 44 | 0.0 |
| >44 | 0.0 |
| min number | 1 |
| max number | 34 |
| mean | 7 |
| mode | 2 |

Macrocystis pyrifera holdfast diameters.

| | |
|---|---|
| (cases) N= | 99 |
| < 6 | 12.1% |
| 6 - 11 | 40.4% |
| 12 - 17 | 16.2% |
| 18 - 23 | 15.2% |
| 24 - 29 | 9.1% |
| 30 - 35 | 6.1% |
| 36 - 41 | 1.0% |
| 42 - 47 | 0.0 |
| 48 - 53 | 0.0 |
| 54 - 59 | 0.0 |
| 60 - 65 | 0.0 |
| 66 - 71 | 0.0 |
| 72 - 77 | 0.0 |
| 78 - 83 | 0.0 |
| 84 - 89 | 0.0 |
| >89 | 0.0 |
| min width (cm) | 4 |
| max width (cm) | 38 |
| mean | 14 |
| mode | 8 |

# LOCATION 6 SANTA CRUZ ISLAND - GULL ISLAND SOUTH

*Lophogorgia chilensis* widths

| | |
|---|---|
| (cases) N= | 50 |
| < 5 | 2.0% |
| 5 - 8 | 10.0% |
| 9 - 12 | 2.0% |
| 13 - 16 | 6.0% |
| 17 - 20 | 20.0% |
| 21 - 24 | 8.0% |
| 25 - 28 | 4.0% |
| 29 - 32 | 4.0% |
| 33 - 36 | 6.0% |
| 37 - 40 | 8.0% |
| 41 - 44 | 4.0% |
| 45 - 48 | 0.0 |
| 49 - 52 | 4.0% |
| 53 - 56 | 2.0% |
| 57 - 60 | 8.0% |
| 61 - 64 | 4.0% |
| 65 - 68 | 2.0% |
| 69 - 72 | 2.0% |
| 73 - 76 | 0.0 |
| 77 - 80 | 2.0% |
| 81 - 84 | 2.0% |
| 85 - 88 | 0.0 |
| 89 - 92 | 0.0 |
| 93 - 96 | 0.0 |
| 97 - 100 | 0.0 |
| >100 | 0.0 |
| min width (cm) | 3 |
| max width (cm) | 83 |
| mean | 33 |
| mode | 19 |

*Lophogorgia chilensis* heights

| | |
|---|---|
| (cases) N= | 50 |
| < 5 | 2.0% |
| 5 - 8 | 0.0 |
| 9 - 12 | 0.0 |
| 13 - 16 | 4.0% |
| 17 - 20 | 2.0% |
| 21 - 24 | 4.0% |
| 25 - 28 | 18.0% |
| 29 - 32 | 14.0% |
| 33 - 36 | 8.0% |
| 37 - 40 | 6.0% |
| 41 - 44 | 6.0% |
| 45 - 48 | 12.0% |
| 49 - 52 | 2.0% |
| 53 - 56 | 6.0% |
| 57 - 60 | 6.0% |
| 61 - 64 | 0.0 |
| 65 - 68 | 0.0 |
| 69 - 72 | 0.0 |
| 73 - 76 | 4.0% |
| 77 - 80 | 4.0% |
| 81 - 84 | 0.0 |
| 85 - 88 | 0.0 |
| 89 - 92 | 0.0 |
| 93 - 96 | 2.0% |
| 97 - 100 | 0.0 |
| >100 | 0.0 |
| min height (cm) | 4 |
| max height (cm) | 93 |
| mean | 40 |
| mode | 27 |

*Allopora californica* widths

| | |
|---|---|
| (cases) N= | 51 |
| < 3 | 15.7% |
| 3 - 4 | 9.8% |
| 5 - 6 | 11.8% |
| 7 - 8 | 5.9% |
| 9 - 10 | 7.8% |
| 11 - 12 | 7.8% |
| 13 - 14 | 5.9% |
| 15 - 16 | 3.9% |
| 17 - 18 | 3.9% |
| 19 - 20 | 7.8% |
| 21 - 22 | 5.9% |
| 23 - 24 | 7.8% |
| 25 - 26 | 3.9% |
| 27 - 28 | 0.0 |
| 29 - 30 | 0.0 |
| >30 | 2.0% |
| min width (cm) | 1 |
| max width (cm) | 37 |
| mean | 12 |
| mode | 1 |

*Allopora californica* heights

| | |
|---|---|
| (cases) N= | 51 |
| < 3 | 23.5% |
| 3 - 4 | 23.5% |
| 5 - 6 | 13.7% |
| 7 - 8 | 11.8% |
| 9 - 10 | 7.8% |
| 11 - 12 | 5.9% |
| 13 - 14 | 7.8% |
| 15 - 16 | 3.9% |
| 17 - 18 | 2.0% |
| 19 - 20 | 0.0 |
| 21 - 22 | 0.0 |
| 23 - 24 | 0.0 |
| 25 - 26 | 0.0 |
| 27 - 28 | 0.0 |
| 29 - 30 | 0.0 |
| >30 | 0.0 |
| min height (cm) | 1 |
| max height (cm) | 18 |
| mean | 6 |
| mode | 1 |

LOCATION 7 SANTA CRUZ ISLAND - FRY'S HARBOR

1990 QUADRAT DATA: MEAN NUMBER PER $M^2$

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Macrocystis pyrifera adult | 0.0000 | 0.0000 | 20 |
| Eisenia arborea | 0.0000 | 0.0000 | 20 |
| Pterygophora californica | 0.0000 | 0.0000 | 20 |
| Laminaria farlowii | 0.0000 | 0.0000 | 20 |
| Macrocystis pyrifera juvenile | 0.0000 | 0.0000 | 20 |
| Macrocystis pyrifera all | 0.0000 | 0.0000 | 20 |
| Cypraea spadicea | 0.3500 | 0.5155 | 20 |
| Astraea undosa | 0.0500 | 0.1539 | 20 |
| Patiria miniata | 0.7750 | 0.8656 | 20 |
| Pisaster giganteus | 0.3250 | 0.4375 | 20 |
| Strongylocentrotus franciscanus | 1.6250 | 1.2017 | 20 |
| Strongylocentrotus purpuratus | 9.8250 | 7.4803 | 20 |
| Parastichopus parvimensis | 2.6250 | 2.1452 | 20 |
| Styela monteryensis | 0.1250 | 0.4552 | 20 |
| Lythrypnus dalli | 0.4000 | 0.7363 | 20 |
| Coryphopterus nicholsii | 1.1750 | 0.8156 | 20 |
| Alloclinus holderi | 0.4500 | 0.7052 | 20 |

1990 BAND TRANSECT DATA: MEAN NUMBER PER $M^2$

| | | | |
|---|---|---|---|
| Tethya aurantia | 0.0153 | 0.0194 | 12 |
| Allopora californica | 0.0000 | 0.0000 | 12 |
| Tealia lofotensis | 0.0028 | 0.0065 | 12 |
| Lophogorgia chilensis | 0.0667 | 0.0527 | 12 |
| Muricea fruticosa | 0.0000 | 0.0000 | 12 |
| Muricea californica | 0.0000 | 0.0000 | 12 |
| Panulirus interruptus | 0.0000 | 0.0000 | 12 |
| Haliotis rufescens | 0.0000 | 0.0000 | 12 |
| Haliotis corrugata | 0.0000 | 0.0000 | 12 |
| Haliotis fulgens | 0.0000 | 0.0000 | 12 |
| Kelletia kelletii | 0.0097 | 0.0166 | 12 |
| Megathura crenulata | 0.1319 | 0.0683 | 12 |
| Hinnites giganteus | 0.0236 | 0.0111 | 12 |
| Aplysia californica | 0.0000 | 0.0000 | 12 |
| Pycnopodia helianthoides | 0.0000 | 0.0000 | 12 |
| Lytechinus anamesus | 2.2167 | 2.6785 | 12 |

LOCATION 7 SANTA CRUZ ISLAND - FRY'S HARBOR
1990 RANDOM POINT CONTACT DATA: MEAN PERCENT COVER

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Green algae | 2.8000 | 3.1721 | 25 |
| Miscellaneous brown algae | 0.1000 | 0.5000 | 25 |
| Desmarestia spp. | 0.0000 | 0.0000 | 25 |
| Laminaria farlowii | 0.0000 | 0.0000 | 25 |
| Cystoseira spp. | 0.0000 | 0.0000 | 25 |
| Macrocystis, Eisenia, Pterygophora | 0.0000 | 0.0000 | 25 |
| Miscellaneous red algae | 8.6000 | 7.3272 | 25 |
| Articulated coralline algae | 0.2000 | 0.6922 | 25 |
| Crustose coralline algae | 23.0000 | 15.2069 | 25 |
| Gelidium spp. | 0.0000 | 0.0000 | 25 |
| Gigartina spp. | 0.0000 | 0.0000 | 25 |
| Miscellaneous plants | 1.2000 | 2.5125 | 25 |
| Sponges | 0.6000 | 1.3070 | 25 |
| Corynactis californica | 3.0000 | 4.3899 | 25 |
| Balanophyllia elegans | 0.7000 | 1.8428 | 25 |
| Astrangia lajollaensis | 30.4000 | 12.1980 | 25 |
| Diopatra ornata | 0.0000 | 0.0000 | 25 |
| Phragmatopoma californica | 0.0000 | 0.0000 | 25 |
| Serpulorbis squamigerus | 1.0000 | 2.1651 | 25 |
| Bryozoans, other | 4.7000 | 4.2279 | 25 |
| Diaperoecia californica | 6.2000 | 5.0580 | 25 |
| Pachythyone rubra | 11.6000 | 19.7099 | 25 |
| Tunicates | 0.6000 | 1.3070 | 25 |
| Miscellaneous invertebrates | 15.7000 | 8.6759 | 25 |
| Bare substrate | 7.9000 | 8.8294 | 25 |
| Rock | 82.9000 | 17.7758 | 25 |
| Cobble | 14.7000 | 14.0557 | 25 |
| Sand | 2.4000 | 5.4715 | 25 |

1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| | | | |
|---|---|---|---|
| TOTAL FISH ABUNDANCE | 17.3056 | 47.9850 | 144 |
| Chromis punctipinnis | 157.2500 | 74.5095 | 12 |
| Oxyjulis californica | 3.4167 | 4.7950 | 12 |
| Sebastes mystinus | 25.7500 | 17.1789 | 12 |
| Sebastes serranoides | 0.3333 | 0.6513 | 12 |
| Sebastes atrovirens | 2.0000 | 1.2792 | 12 |
| Paralabrax clathratus | 8.7500 | 10.9555 | 12 |
| Semicossyphus pulcher | 6.2500 | 3.4674 | 12 |
| Embiotoca jacksoni | 1.6667 | 1.0731 | 12 |
| Embiotoca lateralis | 0.0000 | 0.0000 | 12 |
| Damalichthys vacca | 0.9167 | 0.6686 | 12 |
| Hypsypops rubicundus | 1.0833 | 0.7930 | 12 |
| Girella nigricans | 0.2500 | 0.4523 | 12 |

LOCATION 7 SANTA CRUZ ISLAND - FRY'S HARBOR
1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| Species | Date (year/month/day) | Mean | Std Dev | Cases |
|---|---|---|---|---|
| Chromis punctipinnis adult | | 89.9167 | 56.3148 | 12 |
| | 900711 | 93.2500 | 90.7722 | 4 |
| | 900726 | 88.2500 | 37.9840 | 8 |
| Chromis punctipinnis juvenile | | 67.3333 | 43.1874 | 12 |
| | 900711 | 53.0000 | 29.6536 | 4 |
| | 900726 | 74.5000 | 48.7647 | 8 |
| Oxyjulis californica adult | | 3.4167 | 4.7950 | 12 |
| | 900711 | 7.0000 | 7.0711 | 4 |
| | 900726 | 1.6250 | 1.9226 | 8 |
| Oxyjulis californica juvenile | | 0.0000 | 0.0000 | 12 |
| | 900711 | 0.0000 | 0.0000 | 4 |
| | 900726 | 0.0000 | 0.0000 | 8 |
| Sebastes mystinus adult | | 0.0000 | 0.0000 | 12 |
| | 900711 | 0.0000 | 0.0000 | 4 |
| | 900726 | 0.0000 | 0.0000 | 8 |
| Sebastes mystinus juvenile | | 25.7500 | 17.1789 | 12 |
| | 900711 | 29.0000 | 17.0685 | 4 |
| | 900726 | 24.1250 | 18.1615 | 8 |
| Sebastes serranoides adult | | 0.3333 | 0.6513 | 12 |
| | 900711 | 0.7500 | 0.9574 | 4 |
| | 900726 | 0.1250 | 0.3536 | 8 |

| | | | |
|---|---|---|---|
| Sebastes serranoides juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900711 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900726 | 0.0000 | 0.0000 |
| 8 | | | |
| Sebastes atrovirens adult | | 1.8333 | 1.2673 |
| 12 | | | |
| | 900711 | 1.7500 | 1.7078 |
| 4 | | | |
| | 900726 | 1.8750 | 1.1260 |
| 8 | | | |
| Sebastes atrovirens juvenile | | 0.1667 | 0.5774 |
| 12 | | | |
| | 900711 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900726 | 0.2500 | 0.7071 |
| 8 | | | |
| Paralabrax clathratus adult | | 8.6667 | 10.8739 |
| 12 | | | |
| | 900711 | 0.7500 | 1.5000 |
| 4 | | | |
| | 900726 | 12.6250 | 11.4510 |
| 8 | | | |

| | | | |
|---|---|---|---|
| Paralabrax clathratus juvenile | | 0.0833 | 0.2887 |
| 12 | | | |
| | 900711 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900726 | 0.1250 | 0.3536 |
| 8 | | | |
| Semicossyphus pulcher male | | 0.0833 | 0.2887 |
| 12 | | | |
| | 900711 | 0.2500 | 0.5000 |
| 4 | | | |
| | 900726 | 0.0000 | 0.0000 |
| 8 | | | |
| Semicossyphus pulcher female | | 6.1667 | 3.2706 |
| 12 | | | |
| | 900711 | 8.2500 | 3.4034 |
| 4 | | | |
| | 900726 | 5.1250 | 2.8504 |
| 8 | | | |
| Embiotoca jacksoni adult | | 1.6667 | 1.0731 |
| 12 | | | |
| | 900711 | 2.0000 | 0.8165 |
| 4 | | | |
| | 900726 | 1.5000 | 1.1952 |
| 8 | | | |
| Embiotoca jacksoni juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900711 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900726 | 0.0000 | 0.0000 |
| 8 | | | |
| Embiotoca lateralis adult | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900711 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900726 | 0.0000 | 0.0000 |
| 8 | | | |
| Embiotoca lateralis juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900711 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900726 | 0.0000 | 0.0000 |
| 8 | | | |
| Damalichthys vacca adult | | 0.9167 | 0.6686 |
| 12 | | | |
| | 900711 | 0.7500 | 0.5000 |
| 4 | | | |

| | | | |
|---|---|---|---|
| | 900726 | 1.0000 | 0.7559 |
| 8 | | | |
| Damalichthys vacca juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900711 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900726 | 0.0000 | 0.0000 |
| 8 | | | |
| Hypsypops rubicundus adult | | 1.0833 | 0.7930 |
| 12 | | | |
| | 900711 | 1.5000 | 0.5774 |
| 4 | | | |
| | 900726 | 0.8750 | 0.8345 |
| 8 | | | |
| Hypsypops rubicundus juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900711 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900726 | 0.0000 | 0.0000 |
| 8 | | | |
| Girella nigricans adult | | 0.2500 | 0.4523 |
| 12 | | | |
| | 900711 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900726 | 0.3750 | 0.5175 |
| 8 | | | |
| Girella nigricans juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900711 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900726 | 0.0000 | 0.0000 |
| 8 | | | |

LOCATION 7 SANTA CRUZ ISLAND - FRY'S HARBOR
1990 SIZE FREQUENCY DISTRIBUTIONS

Tethya aurantia

| | |
|---|---|
| (cases) N= | 13 |
| < 10 | 0.0 |
| 10 - 19 | 7.7% |
| 20 - 29 | 15.4% |
| 30 - 39 | 53.8% |
| 40 - 49 | 23.1% |
| 50 - 59 | 0.0 |
| 60 - 69 | 0.0 |
| 70 - 79 | 0.0 |
| 80 - 89 | 0.0 |
| 90 - 99 | 0.0 |
| > 99 | 0.0 |
| min size (mm) | 19 |
| max size (mm) | 45 |
| mean | 35 |
| mode | 32 |

Cypraea spadicea

| | |
|---|---|
| (cases) N= | 30 |
| < 30 | 0.0 |
| 30 - 34 | 3.3% |
| 35 - 39 | 13.3% |
| 40 - 44 | 36.7% |
| 45 - 49 | 40.0% |
| 50 - 54 | 3.3% |
| 55 - 59 | 3.3% |
| > 59 | 0.0 |
| min size (mm) | 34 |
| max size (mm) | 59 |
| mean | 44 |
| mode | 45 |

Megathura crenulata

| | |
|---|---|
| (cases) N= | 30 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 0.0 |
| 30 - 39 | 0.0 |
| 40 - 49 | 0.0 |
| 50 - 59 | 3.3% |
| 60 - 69 | 23.3% |
| 70 - 79 | 56.7% |
| 80 - 89 | 16.7% |
| 90 - 99 | 0.0 |
| 100 - 109 | 0.0 |
| 110 - 119 | 0.0 |
| > 119 | 0.0 |
| min size (mm) | 57 |
| max size (mm) | 84 |
| mean | 72 |
| mode | 74 |

Hinnites giganteus

| | |
|---|---|
| (cases) N= | 58 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 5.2% |
| 30 - 39 | 25.9% |
| 40 - 49 | 20.7% |
| 50 - 59 | 20.7% |
| 60 - 69 | 5.2% |
| 70 - 79 | 12.1% |
| 80 - 89 | 5.2% |
| 90 - 99 | 3.4% |
| 100 - 109 | 1.7% |
| 110 - 119 | 0.0 |
| 120 - 129 | 0.0 |
| 130 - 139 | 0.0 |
| 140 - 149 | 0.0 |
| > 149 | 0.0 |
| min size (mm) | 29 |
| max size (mm) | 101 |
| mean | 52 |
| mode | 30 |

Patiria miniata

| | |
|---|---|
| (cases) N= | 90 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 2.2% |
| 30 - 39 | 10.0% |
| 40 - 49 | 14.4% |
| 50 - 59 | 23.3% |
| 60 - 69 | 34.4% |
| 70 - 79 | 13.3% |
| 80 - 89 | 2.2% |
| 90 - 99 | 0.0 |
| > 99 | 0.0 |
| min size (mm) | 20 |
| max size (mm) | 83 |
| mean | 57 |
| mode | 67 |

# LOCATION 7 SANTA CRUZ ISLAND - FRY'S HARBOR

## Pisaster giganteus

| | |
|---|---|
| (cases) N= | 76 |
| < 20 | 0.0 |
| 20 - 39 | 0.0 |
| 40 - 59 | 0.0 |
| 60 - 79 | 1.3% |
| 80 - 99 | 11.8% |
| 100 - 119 | 34.2% |
| 120 - 139 | 19.7% |
| 140 - 159 | 19.7% |
| 160 - 179 | 9.2% |
| 180 - 199 | 1.3% |
| 200 - 219 | 2.6% |
| 220 - 239 | 0.0 |
| 240 - 259 | 0.0 |
| 260 - 279 | 0.0 |
| 280 - 299 | 0.0 |
| > 299 | 0.0 |
| min size (mm) | 69 |
| max size (mm) | 208 |
| mean | 128 |
| mode | 110 |

## Lytechinus anamesus

| | |
|---|---|
| (cases) N= | 113 |
| < 5 | 0.0 |
| 5 - 9 | 0.0 |
| 10 - 14 | 3.5% |
| 15 - 19 | 39.8% |
| 20 - 24 | 49.6% |
| 25 - 29 | 6.2% |
| 30 - 34 | 0.9% |
| 35 - 39 | 0.0 |
| 40 - 44 | 0.0 |
| 45 - 49 | 0.0 |
| > 49 | 0.0 |
| min size (mm) | 13 |
| max size (mm) | 32 |
| mean | 20 |
| mode | 20 |

## Strongylocentrotus franciscanus

| | |
|---|---|
| (cases) N= | 105 |
| < 5 | 0.0 |
| 5 - 9 | 0.0 |
| 10 - 14 | 0.0 |
| 15 - 19 | 0.0 |
| 20 - 24 | 4.8% |
| 25 - 29 | 1.0% |
| 30 - 34 | 1.9% |
| 35 - 39 | 8.6% |
| 40 - 44 | 2.9% |
| 45 - 49 | 4.8% |
| 50 - 54 | 8.6% |
| 55 - 59 | 4.8% |
| 60 - 64 | 6.7% |
| 65 - 69 | 7.6% |
| 70 - 74 | 13.3% |
| 75 - 79 | 8.6% |
| 80 - 84 | 6.7% |
| 85 - 90 | 8.6% |
| 90 - 94 | 5.7% |
| 95 - 99 | 2.9% |
| 100 - 104 | 1.9% |
| 105 - 109 | 1.0% |
| > 109 | 0.0 |
| min size (mm) | 20 |
| max size (mm) | 107 |
| mean | 65 |
| mode | 81 |

## Strongylocentrotus purpuratus

| | |
|---|---|
| (cases) N= | 118 |
| < 5 | 0.0 |
| 5 - 9 | 0.8% |
| 10 - 14 | 2.5% |
| 15 - 19 | 10.2% |
| 20 - 24 | 33.9% |
| 25 - 29 | 33.1% |
| 30 - 34 | 18.6% |
| 35 - 39 | 0.8% |
| 40 - 44 | 0.0 |
| 45 - 49 | 0.0 |
| 50 - 54 | 0.0 |
| 55 - 59 | 0.0 |
| 60 - 64 | 0.0 |
| 65 - 69 | 0.0 |
| 70 - 74 | 0.0 |
| 75 - 79 | 0.0 |
| 80 - 84 | 0.0 |
| 85 - 90 | 0.0 |
| 90 - 94 | 0.0 |
| 95 - 99 | 0.0 |
| 100 - 104 | 0.0 |
| 105 - 109 | 0.0 |
| > 109 | 0.0 |
| min size (mm) | 8 |
| max size (mm) | 39 |
| mean | 25 |
| mode | 22 |

Parastichopus parvimensis

| | |
|---|---|
| (cases) N= | 30 |
| < 5 | 0.0 |
| 5 - 6 | 0.0 |
| 7 - 8 | 3.3% |
| 9 - 10 | 20.0% |
| 11 - 12 | 36.7% |
| 13 - 14 | 33.3% |
| 15 - 16 | 6.7% |
| 17 - 18 | 0.0 |
| 19 - 20 | 0.0 |
| 21 - 22 | 0.0 |
| > 22 | 0.0 |
| min size (cm) | 8 |
| max size (cm) | 15 |
| mean | 12 |
| mode | 12 |

Lophogorgia chilensis widths.

| | |
|---|---|
| (cases) N= | 63 |
| < 5 | 0.0 |
| 5 - 8 | 4.8% |
| 9 - 12 | 11.1% |
| 13 - 16 | 17.5% |
| 17 - 20 | 15.9% |
| 21 - 24 | 11.1% |
| 25 - 28 | 7.9% |
| 29 - 32 | 7.9% |
| 33 - 36 | 1.6% |
| 37 - 40 | 0.0 |
| 41 - 44 | 3.2% |
| 45 - 48 | 1.6% |
| 49 - 52 | 1.6% |
| 53 - 56 | 0.0 |
| 57 - 60 | 6.3% |
| 61 - 64 | 0.0 |
| 65 - 68 | 3.2% |
| 69 - 72 | 0.0 |
| 73 - 76 | 3.2% |
| 77 - 80 | 1.6% |
| 81 - 84 | 0.0 |
| 85 - 88 | 0.0 |
| 89 - 92 | 0.0 |
| 93 - 96 | 0.0 |
| 97 - 100 | 0.0 |
| > 100 | 1.6% |
| min width (cm) | 6 |
| max width (cm) | 117 |
| mean | 29 |
| mode | 13 |

Lophogorgia chilensis heights.

| | |
|---|---|
| (cases) N= | 63 |
| < 5 | 0.0 |
| 5 - 8 | 0.0 |
| 9 - 12 | 4.8% |
| 13 - 16 | 17.5% |
| 17 - 20 | 20.6% |
| 21 - 24 | 14.3% |
| 25 - 28 | 9.5% |
| 29 - 32 | 4.8% |
| 33 - 36 | 1.6% |
| 37 - 40 | 4.8% |
| 41 - 44 | 1.6% |
| 45 - 48 | 1.6% |
| 49 - 52 | 3.2% |
| 53 - 56 | 3.2% |
| 57 - 60 | 3.2% |
| 61 - 64 | 6.3% |
| 65 - 68 | 1.6% |
| 69 - 72 | 1.6% |
| 73 - 76 | 0.0 |
| 77 - 80 | 0.0 |
| 81 - 84 | 0.0 |
| 85 - 88 | 0.0 |
| 89 - 92 | 0.0 |
| 93 - 96 | 0.0 |
| 97 - 100 | 0.0 |
| >100 | 0.0 |
| min height (cm) | 9 |
| max height (cm) | 71 |
| mean | 29 |
| mode | 19 |

LOCATION 8 SANTA CRUZ ISLAND - PELICAN BAY

1990 QUADRAT DATA: MEAN NUMBER PER $M^2$

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Macrocystis pyrifera adult | 0.0000 | 0.0000 | 20 |
| Eisenia arborea | 0.0000 | 0.0000 | 20 |
| Pterygophora californica | 0.0000 | 0.0000 | 20 |
| Laminaria farlowii | 0.0000 | 0.0000 | 20 |
| Macrocystis pyrifera juvenile | 0.0000 | 0.0000 | 20 |
| Macrocystis pyrifera all | 0.0000 | 0.0000 | 20 |
| Cypraea spadicea | 0.1500 | 0.5643 | 20 |
| Astraea undosa | 1.4750 | 1.3905 | 20 |
| Patiria miniata | 0.1500 | 0.2856 | 20 |
| Pisaster giganteus | 0.0000 | 0.0000 | 20 |
| Strongylocentrotus franciscanus | 2.7250 | 1.1639 | 20 |
| Strongylocentrotus purpuratus | 9.9750 | 8.7951 | 20 |
| Parastichopus parvimensis | 1.9000 | 0.8522 | 20 |
| Styela monteryensis | 0.0000 | 0.0000 | 20 |
| Lythrypnus dalli | 0.1250 | 0.3932 | 20 |
| Coryphopterus nicholsii | 5.0750 | 1.2061 | 20 |
| Alloclinus holderi | 0.2000 | 0.7847 | 20 |

1990 BAND TRANSECT DATA: MEAN NUMBER PER $M^2$

| | | | |
|---|---|---|---|
| Tethya aurantia | 0.0056 | 0.0082 | 12 |
| Allopora californica | 0.0000 | 0.0000 | 12 |
| Tealia lofotensis | 0.0000 | 0.0000 | 12 |
| Lophogorgia chilensis | 0.0708 | 0.0782 | 12 |
| Muricea fruticosa | 0.0000 | 0.0000 | 12 |
| Muricea californica | 0.0000 | 0.0000 | 12 |
| Panulirus interruptus | 0.0000 | 0.0000 | 12 |
| Haliotis rufescens | 0.0000 | 0.0000 | 12 |
| Haliotis corrugata | 0.0014 | 0.0048 | 12 |
| Haliotis fulgens | 0.0000 | 0.0000 | 12 |
| Kelletia kelletii | 0.0208 | 0.0215 | 12 |
| Megathura crenulata | 0.0111 | 0.0192 | 12 |
| Hinnites giganteus | 0.1000 | 0.0937 | 12 |
| Aplysia californica | 0.0042 | 0.0075 | 12 |
| Pycnopodia helianthoides | 0.0000 | 0.0000 | 12 |
| Lytechinus anamesus | 0.0069 | 0.0150 | 12 |

LOCATION 8 SANTA CRUZ ISLAND - PELICAN BAY
1990 RANDOM POINT CONTACT DATA: MEAN PERCENT COVER

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Green algae | 14.5000 | 9.6825 | 25 |
| Miscellaneous brown algae | 2.2000 | 3.9739 | 25 |
| Desmarestia spp. | 0.0000 | 0.0000 | 25 |
| Laminaria farlowii | 0.0000 | 0.0000 | 25 |
| Cystoseira spp. | 0.0000 | 0.0000 | 25 |
| Macrocystis, Eisenia, Pterygophora | 0.0000 | 0.0000 | 25 |
| Miscellaneous red algae | 2.4000 | 3.9184 | 25 |
| Articulated coralline algae | 0.9000 | 1.4216 | 25 |
| Crustose coralline algae | 18.3000 | 12.3474 | 25 |
| Gelidium spp. | 0.2000 | 0.6922 | 25 |
| Gigartina spp. | 0.0000 | 0.0000 | 25 |
| Miscellaneous plants | 2.0000 | 3.0619 | 25 |
| Sponges | 0.1000 | 0.5000 | 25 |
| Corynactis californica | 1.8000 | 2.3408 | 25 |
| Balanophyllia elegans | 0.4000 | 0.9354 | 25 |
| Astrangia lajollaensis | 16.1000 | 8.8412 | 25 |
| Diopatra ornata | 0.3000 | 1.0992 | 25 |
| Phragmatopoma californica | 0.0000 | 0.0000 | 25 |
| Serpulorbis squamigerus | 1.1000 | 1.6266 | 25 |
| Bryozoans, other | 2.5000 | 2.9756 | 25 |
| Diaperoecia californica | 1.3000 | 1.9257 | 25 |
| Tunicates | 0.8000 | 1.3919 | 25 |
| Miscellaneous invertebrates | 30.9000 | 9.8921 | 25 |
| Bare substrate | 18.6000 | 13.8459 | 25 |
| Rock | 63.8000 | 17.6352 | 25 |
| Cobble | 14.9000 | 12.8184 | 25 |
| Sand | 21.2000 | 16.8498 | 25 |

1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| | | | |
|---|---|---|---|
| TOTAL FISH ABUNDANCE | 3.6944 | 11.1927 | 144 |
| Chromis punctipinnis | 27.3333 | 29.7973 | 12 |
| Oxyjulis californica | 0.0833 | 0.2887 | 12 |
| Sebastes mystinus | 0.0000 | 0.0000 | 12 |
| Sebastes serranoides | 0.0000 | 0.0000 | 12 |
| Sebastes atrovirens | 0.0833 | 0.2887 | 12 |
| Paralabrax clathratus | 5.1667 | 2.2896 | 12 |
| Semicossyphus pulcher | 2.5000 | 0.9045 | 12 |
| Embiotoca jacksoni | 5.7500 | 2.8324 | 12 |
| Embiotoca lateralis | 0.0000 | 0.0000 | 12 |
| Damalichthys vacca | 1.3333 | 3.0847 | 12 |
| Hypsypops rubicundus | 2.0833 | 1.3790 | 12 |
| Girella nigricans | 0.0000 | 0.0000 | 12 |

LOCATION 8 SANTA CRUZ ISLAND - PELICAN BAY
1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| Species | Date (year/month/day) | Mean | Std Dev | Cases |
|---|---|---|---|---|
| Chromis punctipinnis adult | | 4.8333 | 6.5759 | 12 |
| | 900712 | 0.5000 | 0.5774 | 4 |
| | 900726 | 7.0000 | 7.1913 | 8 |
| Chromis punctipinnis juvenile | | 22.5000 | 30.6609 | 12 |
| | 900712 | 47.5000 | 41.4447 | 4 |
| | 900726 | 10.0000 | 14.3328 | 8 |
| Oxyjulis californica adult | | 0.0833 | 0.2887 | 12 |
| | 900712 | 0.0000 | 0.0000 | 4 |
| | 900726 | 0.1250 | 0.3536 | 8 |
| Oxyjulis californica juvenile | | 0.0000 | 0.0000 | 12 |
| | 900712 | 0.0000 | 0.0000 | 4 |
| | 900726 | 0.0000 | 0.0000 | 8 |
| Sebastes mystinus adult | | 0.0000 | 0.0000 | 12 |
| | 900712 | 0.0000 | 0.0000 | 4 |
| | 900726 | 0.0000 | 0.0000 | 8 |
| Sebastes mystinus juvenile | | 0.0000 | 0.0000 | 12 |
| | 900712 | 0.0000 | 0.0000 | 4 |
| | 900726 | 0.0000 | 0.0000 | 8 |
| Sebastes serranoides adult | | 0.0000 | 0.0000 | 12 |
| | 900712 | 0.0000 | 0.0000 | 4 |
| | 900726 | 0.0000 | 0.0000 | 8 |

| | | | |
|---|---|---|---|
| Sebastes serranoides juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900712 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900726 | 0.0000 | 0.0000 |
| 8 | | | |
| Sebastes atrovirens adult | | 0.0833 | 0.2887 |
| 12 | | | |
| | 900712 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900726 | 0.1250 | 0.3536 |
| 8 | | | |
| Sebastes atrovirens juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900712 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900726 | 0.0000 | 0.0000 |
| 8 | | | |
| Paralabrax clathratus adult | | 5.1667 | 2.2896 |
| 12 | | | |
| | 900712 | 3.5000 | 1.2910 |
| 4 | | | |
| | 900726 | 6.0000 | 2.2678 |
| 8 | | | |

| | | | |
|---|---|---|---|
| Paralabrax clathratus juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900712 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900726 | 0.0000 | 0.0000 |
| 8 | | | |
| Semicossyphus pulcher male | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900712 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900726 | 0.0000 | 0.0000 |
| 8 | | | |
| Semicossyphus pulcher female | | 2.5000 | 0.9045 |
| 12 | | | |
| | 900712 | 2.7500 | 0.9574 |
| 4 | | | |
| | 900726 | 2.3750 | 0.9161 |
| 8 | | | |
| Embiotoca jacksoni adult | | 5.7500 | 2.8324 |
| 12 | | | |
| | 900712 | 4.7500 | 0.9574 |
| 4 | | | |
| | 900726 | 6.2500 | 3.3700 |
| 8 | | | |
| Embiotoca jacksoni juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900712 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900726 | 0.0000 | 0.0000 |
| 8 | | | |
| Embiotoca lateralis adult | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900712 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900726 | 0.0000 | 0.0000 |
| 8 | | | |
| Embiotoca lateralis juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900712 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900726 | 0.0000 | 0.0000 |
| 8 | | | |
| Damalichthys vacca adult | | 1.3333 | 3.0847 |
| 12 | | | |
| | 900712 | 0.7500 | 0.5000 |
| 4 | | | |

| | | | |
|---|---|---|---|
| | 900726 | 1.6250 | 3.8149 |
| 8 | | | |
| Damalichthys vacca juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900712 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900726 | 0.0000 | 0.0000 |
| 8 | | | |
| Hypsypops rubicundus adult | | 2.0833 | 1.3790 |
| 12 | | | |
| | 900712 | 2.7500 | 1.8930 |
| 4 | | | |
| | 900726 | 1.7500 | 1.0351 |
| 8 | | | |
| Hypsypops rubicundus juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900712 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900726 | 0.0000 | 0.0000 |
| 8 | | | |
| Girella nigricans adult | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900712 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900726 | 0.0000 | 0.0000 |
| 8 | | | |
| Girella nigricans juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900712 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900726 | 0.0000 | 0.0000 |
| 8 | | | |

# LOCATION 8 SANTA CRUZ ISLAND - PELICAN BAY
# 1990 SIZE FREQUENCY DISTRIBUTIONS

## Haliotis corrugata

| | |
|---|---|
| (cases) N= | 2 |
| < 25 | 50.0% |
| 25 - 29 | 0.0 |
| 30 - 34 | 50.0% |
| 35 - 39 | 0.0 |
| >40 | 0.0 |
| min size (mm) | 20 |
| max size (mm) | 33 |
| mean | 27 |
| mode | 20 |

## Cypraea spadicea

| | |
|---|---|
| (cases) N= | 39 |
| < 30 | 0.0 |
| 30 - 34 | 2.6% |
| 35 - 39 | 12.8% |
| 40 - 44 | 41.0% |
| 45 - 49 | 35.9% |
| 50 - 54 | 7.7% |
| 55 - 59 | 0.0 |
| > 59 | 0.0 |
| min size (mm) | 32 |
| max size (mm) | 52 |
| mean | 43 |
| mode | 40 |

## Astraea undosa

| | |
|---|---|
| (cases) N= | 62 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 1.6% |
| 30 - 39 | 0.0 |
| 40 - 49 | 0.0 |
| 50 - 59 | 35.5% |
| 60 - 69 | 58.1% |
| 70 - 79 | 4.8% |
| 80 - 89 | 0.0 |
| 90 - 99 | 0.0 |
| 100 - 109 | 0.0 |
| 110 - 119 | 0.0 |
| > 119 | 0.0 |
| min size (mm) | 20 |
| max size (mm) | 78 |
| mean | 61 |
| mode | 62 |

## Megathura crenulata

| | |
|---|---|
| (cases) N= | 23 |
| < 10 | 0.0 |
| 10 - 19 | 8.7% |
| 20 - 29 | 8.7% |
| 30 - 39 | 0.0 |
| 40 - 49 | 8.7% |
| 50 - 59 | 0.0 |
| 60 - 69 | 8.7% |
| 70 - 79 | 34.8% |
| 80 - 89 | 21.7% |
| 90 - 99 | 4.3% |
| 100 - 109 | 4.3% |
| 110 - 119 | 0.0 |
| > 119 | 0.0 |
| min size (mm) | 15 |
| max size (mm) | 100 |
| mean | 66 |
| mode | 72 |

## Hinnites giganteus

| | |
|---|---|
| (cases) N= | 53 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 7.5% |
| 30 - 39 | 7.5% |
| 40 - 49 | 17.0% |
| 50 - 59 | 20.8% |
| 60 - 69 | 18.9% |
| 70 - 79 | 15.1% |
| 80 - 89 | 3.8% |
| 90 - 99 | 3.8% |
| 100 - 109 | 0.0 |
| 110 - 119 | 1.9% |
| 120 - 129 | 0.0 |
| 130 - 139 | 3.8% |
| 140 - 149 | 0.0 |
| > 149 | 0.0 |
| min size (mm) | 25 |
| max size (mm) | 134 |
| mean | 61 |
| mode | 43 |

Patiria miniata

| | |
|---|---|
| (cases) N= | 54 |
| < 10 | 0.0 |
| 10 - 19 | 11.1% |
| 20 - 29 | 9.3% |
| 30 - 39 | 0.0 |
| 40 - 49 | 7.4% |
| 50 - 59 | 11.1% |
| 60 - 69 | 40.7% |
| 70 - 79 | 14.8% |
| 80 - 89 | 5.6% |
| 90 - 99 | 0.0 |
| > 99 | 0.0 |
| min size (mm) | 11 |
| max size (mm) | 88 |
| mean | 56 |
| mode | 67 |

Pisaster giganteus

| | |
|---|---|
| (cases) N= | 44 |
| < 20 | 0.0 |
| 20 - 39 | 2.3% |
| 40 - 59 | 2.3% |
| 60 - 79 | 0.0 |
| 80 - 99 | 0.0 |
| 100 - 119 | 0.0 |
| 120 - 139 | 11.4% |
| 140 - 159 | 18.2% |
| 160 - 179 | 11.4% |
| 180 - 199 | 20.5% |
| 200 - 219 | 18.2% |
| 220 - 239 | 9.1% |
| 240 - 259 | 2.3% |
| 260 - 279 | 4.5% |
| 280 - 299 | 0.0 |
| > 299 | 0.0 |
| min size (mm) | 28 |
| max size (mm) | 275 |
| mean | 177 |
| mode | 180 |

Strongylocentrotus franciscanus

| | |
|---|---|
| (cases) N= | 102 |
| < 5 | 0.0 |
| 5 - 9 | 0.0 |
| 10 - 14 | 0.0 |
| 15 - 19 | 6.9% |
| 20 - 24 | 7.8% |
| 25 - 29 | 21.6% |
| 30 - 34 | 13.7% |
| 35 - 39 | 20.6% |
| 40 - 44 | 14.7% |
| 45 - 49 | 4.9% |
| 50 - 54 | 2.9% |
| 55 - 59 | 2.0% |
| 60 - 64 | 2.0% |
| 65 - 69 | 2.0% |
| 70 - 74 | 0.0 |
| 75 - 79 | 0.0 |
| 80 - 84 | 0.0 |
| 85 - 90 | 1.0% |
| 90 - 94 | 0.0 |
| 95 - 99 | 0.0 |
| 100 - 104 | 0.0 |
| 105 - 109 | 0.0 |
| > 109 | 0.0 |
| min size (mm) | 18 |
| max size (mm) | 88 |
| mean | 35 |
| mode | 28 |

Strongylocentrotus purpuratus

| | |
|---|---|
| (cases) N= | 126 |
| < 5 | 0.0 |
| 5 - 9 | 0.0 |
| 10 - 14 | 0.8% |
| 15 - 19 | 2.4% |
| 20 - 24 | 23.8% |
| 25 - 29 | 39.7% |
| 30 - 34 | 19.8% |
| 35 - 39 | 10.3% |
| 40 - 44 | 3.2% |
| 45 - 49 | 0.0 |
| 50 - 54 | 0.0 |
| 55 - 59 | 0.0 |
| 60 - 64 | 0.0 |
| 65 - 69 | 0.0 |
| 70 - 74 | 0.0 |
| 75 - 79 | 0.0 |
| 80 - 84 | 0.0 |
| 85 - 90 | 0.0 |
| 90 - 94 | 0.0 |
| 95 - 99 | 0.0 |
| 100 - 104 | 0.0 |
| 105 - 109 | 0.0 |
| > 109 | 0.0 |
| min size (mm) | 14 |
| max size (mm) | 43 |
| mean | 28 |
| mode | 24 |

Parastichopus parvimensis

| | |
|---|---|
| (cases) N= | 30 |
| < 5 | 0.0 |
| 5 - 6 | 0.0 |
| 7 - 8 | 6.7% |
| 9 - 10 | 30.0% |
| 11 - 12 | 53.3% |
| 13 - 14 | 6.7% |
| 15 - 16 | 3.3% |
| 17 - 18 | 0.0 |
| 19 - 20 | 0.0 |
| 21 - 22 | 0.0 |
| > 22 | 0.0 |
| min size (cm) | 8 |
| max size (cm) | 15 |
| mean | 11 |
| mode | 12 |

Lophogorgia chilensis widths

| | |
|---|---|
| (cases) N= | 30 |
| < 5 | 0.0 |
| 5 - 8 | 0.0 |
| 9 - 12 | 0.0 |
| 13 - 16 | 6.7% |
| 17 - 20 | 16.7% |
| 21 - 24 | 10.0% |
| 25 - 28 | 13.3% |
| 29 - 32 | 6.7% |
| 33 - 36 | 23.3% |
| 37 - 40 | 10.0% |
| 41 - 44 | 3.3% |
| 45 - 48 | 10.0% |
| 49 - 52 | 0.0 |
| 53 - 56 | 0.0 |
| >57 | 0.0 |
| min width (cm) | 13 |
| max width (cm) | 48 |
| mean | 30 |
| mode | 18 |

Lophogorgia chilensis heights

| | |
|---|---|
| (cases) N= | 30 |
| < 5 | 0.0 |
| 5 - 8 | 0.0 |
| 9 - 12 | 0.0 |
| 13 - 16 | 0.0 |
| 17 - 20 | 0.0 |
| 21 - 24 | 6.7% |
| 25 - 28 | 6.7% |
| 29 - 32 | 13.3% |
| 33 - 36 | 40.0% |
| 37 - 40 | 13.3% |
| 41 - 44 | 10.0% |
| 45 - 48 | 3.3% |
| 49 - 52 | 6.7% |
| 53 - 56 | 0.0 |
| >57 | 0.0 |
| min height (cm) | 21 |
| max height (cm) | 50 |
| mean | 35 |
| mode | 36 |

LOCATION 9 SANTA CRUZ ISLAND - SCORPION ANCHORAGE

1990 QUADRAT DATA: MEAN NUMBER PER $M^2$

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Macrocystis pyrifera adult | 0.0000 | 0.0000 | 20 |
| Eisenia arborea | 0.0000 | 0.0000 | 20 |
| Pterygophora californica | 0.0000 | 0.0000 | 20 |
| Laminaria farlowii | 0.0000 | 0.0000 | 20 |
| Macrocystis pyrifera juvenile | 0.0000 | 0.0000 | 20 |
| Macrocystis pyrifera all | 0.0000 | 0.0000 | 20 |
| Cypraea spadicea | 0.0000 | 0.0000 | 20 |
| Astraea undosa | 1.5500 | 1.2763 | 20 |
| Patiria miniata | 0.0250 | 0.1118 | 20 |
| Pisaster giganteus | 0.0000 | 0.0000 | 20 |
| Strongylocentrotus franciscanus | 1.3500 | 1.1596 | 20 |
| Strongylocentrotus purpuratus | 52.6250 | 17.8987 | 20 |
| Parastichopus parvimensis | 0.4750 | 0.3796 | 20 |
| Styela monteryensis | 0.0000 | 0.0000 | 20 |
| Lythrypnus dalli | 0.0000 | 0.0000 | 20 |
| Coryphopterus nicholsii | 0.6250 | 0.5098 | 20 |
| Alloclinus holderi | 0.0000 | 0.0000 | 20 |

1990 BAND TRANSECT DATA: MEAN NUMBER PER $M^2$

| | | | |
|---|---|---|---|
| Tethya aurantia | 0.0042 | 0.0075 | 12 |
| Allopora californica | 0.0000 | 0.0000 | 12 |
| Tealia lofotensis | 0.0000 | 0.0000 | 12 |
| Lophogorgia chilensis | 0.0000 | 0.0000 | 12 |
| Muricea fruticosa | 0.0000 | 0.0000 | 12 |
| Muricea californica | 0.0000 | 0.0000 | 12 |
| Panulirus interruptus | 0.0014 | 0.0048 | 12 |
| Haliotis rufescens | 0.0000 | 0.0000 | 12 |
| Haliotis corrugata | 0.0000 | 0.0000 | 12 |
| Haliotis fulgens | 0.0000 | 0.0000 | 12 |
| Kelletia kelletii | 0.0000 | 0.0000 | 12 |
| Megathura crenulata | 0.0625 | 0.0356 | 12 |
| Hinnites giganteus | 0.0056 | 0.0109 | 12 |
| Aplysia californica | 0.0028 | 0.0065 | 12 |
| Pycnopodia helianthoides | 0.0000 | 0.0000 | 12 |
| Lytechinus anamesus | 0.0333 | 0.0807 | 12 |

LOCATION 9 SANTA CRUZ ISLAND - SCORPION ANCHORAGE
1990 RANDOM POINT CONTACT DATA: MEAN PERCENT COVER

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Green algae | 2.3000 | 5.6329 | 25 |
| Miscellaneous brown algae | 0.0000 | 0.0000 | 25 |
| Desmarestia spp. | 0.0000 | 0.0000 | 25 |
| Laminaria farlowii | 0.0000 | 0.0000 | 25 |
| Cystoseira spp. | 0.0000 | 0.0000 | 25 |
| Macrocystis, Eisenia, Pterygophora | 0.0000 | 0.0000 | 25 |
| Miscellaneous red algae | 1.6000 | 2.1506 | 25 |
| Articulated coralline algae | 2.1000 | 2.3585 | 25 |
| Crustose coralline algae | 37.0000 | 11.7704 | 25 |
| Gelidium spp. | 0.0000 | 0.0000 | 25 |
| Gigartina spp. | 0.0000 | 0.0000 | 25 |
| Miscellaneous plants | 0.3000 | 1.0992 | 25 |
| Sponges | 0.0000 | 0.0000 | 25 |
| Corynactis californica | 0.0000 | 0.0000 | 25 |
| Balanophyllia elegans | 0.3000 | 0.8292 | 25 |
| Astrangia lajollaensis | 2.1000 | 2.2454 | 25 |
| Diopatra ornata | 0.2000 | 0.6922 | 25 |
| Phragmatopoma californica | 0.0000 | 0.0000 | 25 |
| Serpulorbis squamigerus | 6.4000 | 4.8455 | 25 |
| Bryozoans, other | 0.0000 | 0.0000 | 25 |
| Diaperoecia californica | 0.1000 | 0.5000 | 25 |
| Tunicates | 0.0000 | 0.0000 | 25 |
| Miscellaneous invertebrates | 9.6000 | 8.8588 | 25 |
| Bare substrate | 38.4000 | 13.2461 | 25 |
| Rock | 83.9000 | 11.3670 | 25 |
| Cobble | 6.6000 | 4.8348 | 25 |
| Sand | 9.5000 | 11.5470 | 25 |

1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| | | | |
|---|---|---|---|
| TOTAL FISH ABUNDANCE | 16.2917 | 69.0044 | 144 |
| Chromis punctipinnis | 174.5000 | 178.4685 | 12 |
| Oxyjulis californica | 12.0833 | 10.2908 | 12 |
| Sebastes mystinus | 0.1667 | 0.5774 | 12 |
| Sebastes serranoides | 0.0000 | 0.0000 | 12 |
| Sebastes atrovirens | 0.0000 | 0.0000 | 12 |
| Paralabrax clathratus | 3.5833 | 2.6097 | 12 |
| Semicossyphus pulcher | 0.1667 | 0.3892 | 12 |
| Embiotoca jacksoni | 0.7500 | 0.8660 | 12 |
| Embiotoca lateralis | 0.0000 | 0.0000 | 12 |
| Damalichthys vacca | 0.5000 | 0.5222 | 12 |
| Hypsypops rubicundus | 0.7500 | 0.8660 | 12 |
| Girella nigricans | 3.0000 | 2.5226 | 12 |

1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

LOCATION 9 SANTA CRUZ ISLAND - SCORPION ANCHORAGE

| Species | Date (year/month/date) | Mean | Std Dev | Cases |
|---|---|---|---|---|
| Chromis punctipinnis | adult | 10.9167 | 9.2683 | 12 |
| | 900725 | 7.0000 | 8.0416 | 4 |
| | 901025 | 12.8750 | 9.7018 | 8 |
| Chromis punctipinnis | juvenile | 163.5833 | 173.5393 | 12 |
| | 900725 | 2.0000 | 4.0000 | 4 |
| | 901025 | 244.3750 | 157.9204 | 8 |
| Oxyjulis californica | adult | 3.2500 | 2.3404 | 12 |
| | 900725 | 1.0000 | 0.8165 | 4 |
| | 901025 | 4.3750 | 1.9955 | 8 |
| Oxyjulis californica | juvenile | 8.8333 | 8.9120 | 12 |
| | 900725 | 0.0000 | 0.0000 | 4 |
| | 901025 | 13.2500 | 7.6111 | 8 |
| Sebastes mystinus | adult | 0.0000 | 0.0000 | 12 |
| | 900725 | 0.0000 | 0.0000 | 4 |
| | 901025 | 0.0000 | 0.0000 | 8 |
| Sebastes mystinus | juvenile | 0.1667 | 0.5774 | 12 |
| | 900725 | 0.5000 | 1.0000 | 4 |
| | 901025 | 0.0000 | 0.0000 | 8 |
| Sebastes serranoides | adult | 0.0000 | 0.0000 | 12 |
| | 900725 | 0.0000 | 0.0000 | 4 |
| | 901025 | 0.0000 | 0.0000 | 8 |
| Sebastes serranoides | juvenile | 0.0000 | 0.0000 | |

LOCATION 9 SANTA CRUZ ISLAND - SCORPION ANCHORAGE

| | | | |
|---|---|---|---|
| 12 | | | |
| | 900725 | 0.0000 | 0.0000 |
| 4 | | | |
| | 901025 | 0.0000 | 0.0000 |
| 8 | | | |
| Sebastes atrovirens adult | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900725 | 0.0000 | 0.0000 |
| 4 | | | |
| | 901025 | 0.0000 | 0.0000 |
| 8 | | | |
| Sebastes atrovirens juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900725 | 0.0000 | 0.0000 |
| 4 | | | |
| | 901025 | 0.0000 | 0.0000 |
| 8 | | | |
| Paralabrax clathratus adult | | 2.6667 | 1.9695 |
| 12 | | | |
| | 900725 | 0.7500 | 0.9574 |
| 4 | | | |
| | 901025 | 3.6250 | 1.5980 |
| 8 | | | |

| | | | |
|---|---|---|---|
| Paralabrax clathratus juvenile | | 0.9167 | 0.9962 |
| 12 | | | |
| | 900725 | 0.0000 | 0.0000 |
| 4 | | | |
| | 901025 | 1.3750 | 0.9161 |
| 8 | | | |
| Semicossyphus pulcher male | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900725 | 0.0000 | 0.0000 |
| 4 | | | |
| | 901025 | 0.0000 | 0.0000 |
| 8 | | | |
| Semicossyphus pulcher female | | 0.1667 | 0.3892 |
| 12 | | | |
| | 900725 | 0.2500 | 0.5000 |
| 4 | | | |
| | 901025 | 0.1250 | 0.3536 |
| 8 | | | |
| Embiotoca jacksoni adult | | 0.7500 | 0.8660 |
| 12 | | | |
| | 900725 | 0.2500 | 0.5000 |
| 4 | | | |
| | 901025 | 1.0000 | 0.9258 |
| 8 | | | |
| Embiotoca jacksoni juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900725 | 0.0000 | 0.0000 |
| 4 | | | |
| | 901025 | 0.0000 | 0.0000 |
| 8 | | | |
| Embiotoca lateralis adult | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900725 | 0.0000 | 0.0000 |
| 4 | | | |
| | 901025 | 0.0000 | 0.0000 |
| 8 | | | |
| Embiotoca lateralis juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900725 | 0.0000 | 0.0000 |
| 4 | | | |
| | 901025 | 0.0000 | 0.0000 |
| 8 | | | |
| Damalichthys vacca adult | | 0.5000 | 0.5222 |
| 12 | | | |
| | 900725 | 0.5000 | 0.5774 |
| 4 | | | |

| | | | |
|---|---|---|---|
| | 901025 | 0.5000 | 0.5345 |
| 8 | | | |
| Damalichthys vacca juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900725 | 0.0000 | 0.0000 |
| 4 | | | |
| | 901025 | 0.0000 | 0.0000 |
| 8 | | | |
| Hypsypops rubicundus adult | | 0.7500 | 0.8660 |
| 12 | | | |
| | 900725 | 0.2500 | 0.5000 |
| 4 | | | |
| | 901025 | 1.0000 | 0.9258 |
| 8 | | | |
| Hypsypops rubicundus juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900725 | 0.0000 | 0.0000 |
| 4 | | | |
| | 901025 | 0.0000 | 0.0000 |
| 8 | | | |
| Girella nigricans adult | | 1.2500 | 1.5448 |
| 12 | | | |
| | 900725 | 0.2500 | 0.5000 |
| 4 | | | |
| | 901025 | 1.7500 | 1.6690 |
| 8 | | | |
| Girella nigricans juvenile | | 1.7500 | 1.8153 |
| 12 | | | |
| | 900725 | 0.0000 | 0.0000 |
| 4 | | | |
| | 901025 | 2.6250 | 1.5980 |
| 8 | | | |

LOCATION 9 SANTA CRUZ ISLAND - SCORPION ANCHORAGE
1990 SIZE FREQUENCY DISTRIBUTIONS

Cypraea spadicea

| | |
|---|---|
| (cases) N= | 32 |
| < 30 | 0.0 |
| 30 - 34 | 6.3% |
| 35 - 39 | 18.8% |
| 40 - 44 | 31.3% |
| 45 - 49 | 25.0% |
| 50 - 54 | 18.8% |
| 55 - 59 | 0.0 |
| > 59 | 0.0 |
| min size (mm) | 32 |
| max size (mm) | 53 |
| mean | 44 |
| mode | 44 |

Astraea undosa

| | |
|---|---|
| (cases) N= | 54 |
| < 10 | 0.0 |
| 10 - 19 | 1.9% |
| 20 - 29 | 0.0 |
| 30 - 39 | 5.6% |
| 40 - 49 | 7.4% |
| 50 - 59 | 27.8% |
| 60 - 69 | 53.7% |
| 70 - 79 | 3.7% |
| 80 - 89 | 0.0 |
| 90 - 99 | 0.0 |
| 100 - 109 | 0.0 |
| 110 - 119 | 0.0 |
| > 119 | 0.0 |
| min size (mm) | 12 |
| max size (mm) | 75 |
| mean | 57 |
| mode | 60 |

Patiria miniata

| | |
|---|---|
| (cases) N= | 47 |
| < 10 | 0.0 |
| 10 - 19 | 4.3% |
| 20 - 29 | 4.3% |
| 30 - 39 | 2.1% |
| 40 - 49 | 19.1% |
| 50 - 59 | 27.7% |
| 60 - 69 | 23.4% |
| 70 - 79 | 8.5% |
| 80 - 89 | 8.5% |
| 90 - 99 | 2.1% |
| > 99 | 0.0 |
| min size (mm) | 13 |
| max size (mm) | 92 |
| mean | 57 |
| mode | 53 |

Megathura crenulata

| | |
|---|---|
| (cases) N= | 22 |
| < 10 | 0.0 |
| 10 - 19 | 9.1% |
| 20 - 29 | 4.5% |
| 30 - 39 | 0.0 |
| 40 - 49 | 0.0 |
| 50 - 59 | 0.0 |
| 60 - 69 | 0.0 |
| 70 - 79 | 18.2% |
| 80 - 89 | 50.0% |
| 90 - 99 | 13.6% |
| 100 - 109 | 4.5% |
| > 109 | 0.0 |
| min size (mm) | 17 |
| max size (mm) | 101 |
| mean | 75 |
| mode | 81 |

Hinnites giganteus

| | |
|---|---|
| (cases) N= | 18 |
| < 20 | 0.0 |
| 20 - 29 | 5.6% |
| 30 - 39 | 16.7% |
| 40 - 49 | 11.1% |
| 50 - 59 | 22.2% |
| 60 - 69 | 11.1% |
| 70 - 79 | 5.6% |
| 80 - 89 | 11.1% |
| 90 - 99 | 0.0 |
| 100 - 109 | 0.0 |
| 110 - 119 | 11.1% |
| 120 - 129 | 0.0 |
| 130 - 139 | 0.0 |
| 140 - 149 | 5.6% |
| > 149 | 0.0 |
| min size (mm) | 27 |
| max size (mm) | 140 |
| mean | 65 |
| mode | 27 |

Parastichopus parvimensis

| | |
|---|---|
| (cases) N= | 31 |
| < 9 | 0.0 |
| 9 - 10 | 16.1% |
| 11 - 12 | 35.5% |
| 13 - 14 | 32.3% |
| 15 - 16 | 16.1% |
| > 16 | 0.0 |
| min size (cm) | 9 |
| max size (cm) | 16 |
| mean | 12 |
| mode | 11 |

Pisaster giganteus

| | |
|---|---|
| (cases) N= | 12 |
| < 20 | 0.0 |
| 20 - 39 | 0.0 |
| 40 - 59 | 0.0 |
| 60 - 79 | 0.0 |
| 80 - 99 | 0.0 |

| | |
|---|---|
| 100 - 119 | 0.0 |
| 120 - 139 | 8.3% |
| 140 - 159 | 25.0% |
| 160 - 179 | 25.0% |
| 180 - 199 | 8.3% |
| 200 - 219 | 8.3% |
| 220 - 239 | 16.7% |
| 240 - 259 | 8.3% |
| 260 - 279 | 0.0 |
| 280 - 299 | 0.0 |
| > 299 | 0.0 |
| min size (mm) | 129 |
| max size (mm) | 240 |
| mean | 180 |
| mode | 220 |

Strongylocentrotus franciscanus

| | |
|---|---|
| (cases) N= | 109 |
| < 5 | 0.0 |
| 5 - 9 | 0.0 |
| 10 - 14 | 0.0 |
| 15 - 19 | 0.9% |
| 20 - 24 | 6.4% |
| 25 - 29 | 13.8% |
| 30 - 34 | 42.2% |
| 35 - 39 | 18.3% |
| 40 - 44 | 10.1% |
| 45 - 49 | 0.9% |
| 50 - 54 | 1.8% |
| 55 - 59 | 1.8% |
| 60 - 64 | 0.0 |
| 65 - 69 | 1.8% |
| 70 - 74 | 0.0 |
| 75 - 79 | 0.9% |
| 80 - 84 | 0.9% |
| 85 - 90 | 0.0 |
| 90 - 94 | 0.0 |
| 95 - 99 | 0.0 |
| 100 - 104 | 0.0 |
| 105 - 109 | 0.0 |
| > 109 | 0.0 |
| min size (mm) | 18 |
| max size (mm) | 81 |
| mean | 35 |
| mode | 32 |

Lytechinus anamesus

| | |
|---|---|
| (cases) N= | 117 |
| < 5 | 0.0 |
| 5 - 9 | 0.0 |
| 10 - 14 | 0.0 |
| 15 - 19 | 9.4% |
| 20 - 24 | 57.3% |
| 25 - 29 | 31.6% |
| 30 - 34 | 1.7% |
| 35 - 39 | 0.0 |
| 40 - 44 | 0.0 |
| 45 - 49 | 0.0 |
| > 49 | 0.0 |
| min size (mm) | 15 |
| max size (mm) | 30 |
| mean | 23 |
| mode | 21 |

Strongylocentrotus purpuratus

| | |
|---|---|
| (cases) N= | 124 |
| < 5 | 0.0 |
| 5 - 9 | 2.4% |
| 10 - 14 | 2.4% |
| 15 - 19 | 10.5% |
| 20 - 24 | 13.7% |
| 25 - 29 | 62.1% |
| 30 - 34 | 4.0% |
| 35 - 39 | 4.0% |
| 40 - 44 | 0.0 |
| 45 - 49 | 0.8% |
| 50 - 54 | 0.0 |
| 55 - 59 | 0.0 |
| 60 - 64 | 0.0 |
| 65 - 69 | 0.0 |
| 70 - 74 | 0.0 |
| 75 - 79 | 0.0 |
| 80 - 84 | 0.0 |
| 85 - 90 | 0.0 |
| 90 - 94 | 0.0 |
| 95 - 99 | 0.0 |
| 100 - 104 | 0.0 |
| 105 - 109 | 0.0 |
| > 109 | 0.0 |
| min size (mm) | 5 |
| max size (mm) | 46 |
| mean | 25 |
| mode | 27 |

1990 QUADRAT DATA: MEAN NUMBER PER $M^2$

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Macrocystis pyrifera adult | 0.2750 | 0.3432 | 20 |
| Eisenia arborea | 0.1000 | 0.2052 | 20 |
| Pterygophora californica | 0.6000 | 0.7539 | 20 |
| Laminaria farlowii | 0.6000 | 1.0336 | 20 |
| Macrocystis pyrifera juvenile | 0.3250 | 0.4375 | 20 |
| Macrocystis pyrifera all | 0.6000 | 0.5982 | 20 |
| Cypraea spadicea | 0.500 | 0.1539 | 20 |
| Astraea undosa | 0.7000 | 0.6959 | 20 |
| Patiria miniata | 0.0000 | 0.0000 | 20 |
| Pisaster giganteus | 0.1000 | 0.2052 | 20 |
| Lytechinus anamesus | 19.9250 | 45.1691 | 20 |
| Strongylocentrotus franciscanus | 0.3750 | 0.8252 | 20 |
| Strongylocentrotus purpuratus | 9.8500 | 9.3444 | 20 |
| Parastichopus parvimensis | 0.4750 | 0.7340 | 20 |
| Styela monteryensis | 0.0000 | 0.0000 | 20 |
| Lythrypnus dalli | 0.0000 | 0.0000 | 20 |
| Coryphopterus nicholsii | 0.7500 | 0.7522 | 20 |
| Alloclinus holderi | 0.1750 | 0.4064 | 20 |

1990 BAND TRANSECT DATA: MEAN NUMBER PER $M^2$

| | | | |
|---|---|---|---|
| Tethya aurantia | 0.0083 | 0.0112 | 12 |
| Allopora californica | 0.0000 | 0.0000 | 12 |
| Tealia lofotensis | 0.0028 | 0.0096 | 12 |
| Lophogorgia chilensis | 0.1167 | 0.0628 | 12 |
| Muricea fruticosa | 0.0139 | 0.0172 | 12 |
| Muricea californica | 0.0069 | 0.0111 | 12 |
| Panulirus interruptus | 0.0042 | 0.0104 | 12 |
| Haliotis rufescens | 0.0000 | 0.0000 | 12 |
| Haliotis corrugata | 0.0069 | 0.0132 | 12 |
| Haliotis fulgens | 0.0000 | 0.0000 | 12 |
| Kelletia kelletii | 0.0528 | 0.0502 | 12 |
| Megathura crenulata | 0.0306 | 0.0199 | 12 |
| Hinnites giganteus | 0.0042 | 0.0104 | 12 |
| Aplysia californica | 0.0000 | 0.0000 | 12 |
| Pycnopodia helianthoides | 0.0000 | 0.0000 | 12 |
| Lytechinus anamesus | 0.0000 | 0.0000 | 12 |

LOCATION 10 SANTA CRUZ ISLAND - YELLOWBANKS
1990 RANDOM POINT CONTACT DATA: MEAN PERCENT COVER

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Green algae | 0.1000 | 0.5000 | 25 |
| Miscellaneous brown algae | 11.9000 | 19.1115 | 25 |
| Desmarestia spp. | 0.0000 | 0.0000 | 25 |
| Laminaria farlowii | 8.4000 | 9.0393 | 25 |
| Cystoseira spp. | 29.3000 | 15.8857 | 25 |
| Macrocystis, Eisenia, Pterygophora | 36.1000 | 24.7075 | 25 |
| Miscellaneous red algae | 2.9000 | 5.1881 | 25 |
| Articulated coralline algae | 18.1000 | 8.3317 | 25 |
| Crustose coralline algae | 54.1000 | 15.4090 | 25 |
| Gelidium spp. | 0.0000 | 0.0000 | 25 |
| Gigartina spp. | 0.0000 | 0.0000 | 25 |
| Miscellaneous plants | 1.2000 | 2.7119 | 25 |
| Sponges | 0.8000 | 1.3919 | 25 |
| Corynactis californica | 0.7000 | 1.8428 | 25 |
| Balanophyllia elegans | 0.3000 | 0.8292 | 25 |
| Astrangia lajollaensis | 2.5000 | 2.6021 | 25 |
| Diopatra ornata | 0.2000 | 0.6922 | 25 |
| Phragmatopoma californica | 0.1000 | 0.5000 | 25 |
| Serpulorbis squamigerus | 0.0000 | 0.0000 | 25 |
| Bryozoans, other | 13.5000 | 9.2983 | 25 |
| Diaperoecia californica | 4.6000 | 6.4420 | 25 |
| Tunicates | 0.3000 | 0.8292 | 25 |
| Miscellaneous invertebrates | 8.5000 | 7.5691 | 25 |
| Bare substrate | 16.4000 | 12.5225 | 25 |
| Rock | 76.1000 | 24.4106 | 25 |
| Cobble | 15.8000 | 18.1533 | 25 |
| Sand | 8.1000 | 13.3127 | 25 |

1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| | | | |
|---|---|---|---|
| TOTAL FISH ABUNDANCE | 13.3125 | 60.5449 | 96 |
| Chromis punctipinnis | 151.0000 | 161.4338 | 8 |
| Oxyjulis californica | 4.6250 | 4.8972 | 8 |
| Sebastes mystinus | 0.0000 | 0.0000 | 8 |
| Sebastes serranoides | 0.0000 | 0.0000 | 8 |
| Sebastes atrovirens | 0.1250 | 0.3536 | 8 |
| Paralabrax clathratus | 1.5000 | 1.1952 | 8 |
| Semicossyphus pulcher | 1.6250 | 1.5980 | 8 |
| Embiotoca jacksoni | 0.6250 | 1.0607 | 8 |
| Embiotoca lateralis | 0.1250 | 0.3536 | 8 |
| Damalichthys vacca | 0.1250 | 0.3536 | 8 |
| Hypsypops rubicundus | 0.0000 | 0.0000 | 8 |
| Girella nigricans | 0.0000 | 0.0000 | 8 |

LOCATION 10 SANTA CRUZ ISLAND - YELLOWBANKS
1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| Species | Date (year/month/day) | Mean | Std Dev | Cases |
|---|---|---|---|---|
| Chromis punctipinnis adult | | 1.0000 | 1.9272 | 8 |
| | 900810 | 0.0000 | 0.0000 | 4 |
| | 900910 | 2.0000 | 2.4495 | 4 |
| Chromis punctipinnis juvenile | | 150.0000 | 160.3567 | 8 |
| | 900810 | 0.0000 | 0.0000 | 4 |
| | 900910 | 300.0000 | 0.0000 | 4 |
| Oxyjulis californica adult | | 4.6250 | 4.8972 | 8 |
| | 900810 | 4.5000 | 5.4467 | 4 |
| | 900910 | 4.7500 | 5.1235 | 4 |
| Oxyjulis californica juvenile | | 0.0000 | 0.0000 | 8 |
| | 900810 | 0.0000 | 0.0000 | 4 |
| | 900910 | 0.0000 | 0.0000 | 4 |
| Sebastes mystinus adult | | 0.0000 | 0.0000 | 8 |
| | 900810 | 0.0000 | 0.0000 | 4 |
| | 900910 | 0.0000 | 0.0000 | 4 |
| Sebastes mystinus juvenile | | 0.0000 | 0.0000 | 8 |
| | 900810 | 0.0000 | 0.0000 | 4 |
| | 900910 | 0.0000 | 0.0000 | 4 |
| Sebastes serranoides adult | | 0.0000 | 0.0000 | 8 |
| | 900810 | 0.0000 | 0.0000 | 4 |
| | 900910 | 0.0000 | 0.0000 | 4 |

| | | | |
|---|---|---|---|
| Sebastes serranoides juvenile | | 0.0000 | 0.0000 |
| 8 | | | |
| | 900810 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900910 | 0.0000 | 0.0000 |
| 4 | | | |
| Sebastes atrovirens adult | | 0.1250 | 0.3536 |
| 8 | | | |
| | 900810 | 0.2500 | 0.5000 |
| 4 | | | |
| | 900910 | 0.0000 | 0.0000 |
| 4 | | | |
| Sebastes atrovirens juvenile | | 0.0000 | 0.0000 |
| 8 | | | |
| | 900810 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900910 | 0.0000 | 0.0000 |
| 4 | | | |
| Paralabrax clathratus adult | | 1.5000 | 1.1952 |
| 8 | | | |
| | 900810 | 2.2500 | 0.9574 |
| 4 | | | |
| | 900910 | 0.7500 | 0.9574 |
| 4 | | | |

| | | | |
|---|---|---|---|
| Paralabrax clathratus juvenile | | 0.0000 | 0.0000 |
| 8 | | | |
| | 900810 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900910 | 0.0000 | 0.0000 |
| 4 | | | |
| Semicossyphus pulcher male | | 0.0000 | 0.0000 |
| 8 | | | |
| | 900810 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900910 | 0.0000 | 0.0000 |
| 4 | | | |
| Semicossyphus pulcher female | | 1.6250 | 1.5980 |
| 8 | | | |
| | 900810 | 3.0000 | 0.8165 |
| 4 | | | |
| | 900910 | 0.2500 | 0.5000 |
| 4 | | | |
| Embiotoca jacksoni adult | | 0.6250 | 1.0607 |
| 8 | | | |
| | 900810 | 1.0000 | 1.4142 |
| 4 | | | |
| | 900910 | 0.2500 | 0.5000 |
| 4 | | | |
| Embiotoca jacksoni juvenile | | 0.0000 | 0.0000 |
| 8 | | | |
| | 900810 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900910 | 0.0000 | 0.0000 |
| 4 | | | |
| Embiotoca lateralis adult | | 0.1250 | 0.3536 |
| 8 | | | |
| | 900810 | 0.2500 | 0.5000 |
| 4 | | | |
| | 900910 | 0.0000 | 0.0000 |
| 4 | | | |
| Embiotoca lateralis juvenile | | 0.0000 | 0.0000 |
| 8 | | | |
| | 900810 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900910 | 0.0000 | 0.0000 |
| 4 | | | |
| Damalichthys vacca adult | | 0.1250 | 0.3536 |
| 8 | | | |
| | 900810 | 0.2500 | 0.5000 |
| 4 | | | |

| | | |
|---|---|---|
| 900910 | 0.0000 | 0.0000 |
| 4 | | |
| Damalichthys vacca juvenile | 0.0000 | 0.0000 |
| 8 | | |
| 900810 | 0.0000 | 0.0000 |
| 4 | | |
| 900910 | 0.0000 | 0.0000 |
| 4 | | |
| Hypsypops rubicundus adult | 0.0000 | 0.0000 |
| 8 | | |
| 900810 | 0.0000 | 0.0000 |
| 4 | | |
| 900910 | 0.0000 | 0.0000 |
| 4 | | |
| Hypsypops rubicundus juvenile | 0.0000 | 0.0000 |
| 8 | | |
| 900810 | 0.0000 | 0.0000 |
| 4 | | |
| 900910 | 0.0000 | 0.0000 |
| 4 | | |
| Girella nigricans adult | 0.0000 | 0.0000 |
| 8 | | |
| 900810 | 0.0000 | 0.0000 |
| 4 | | |
| 900910 | 0.0000 | 0.0000 |
| 4 | | |
| Girella nigricans juvenile | 0.0000 | 0.0000 |
| 8 | | |
| 900810 | 0.0000 | 0.0000 |
| 4 | | |
| 900910 | 0.0000 | 0.0000 |
| 4 | | |

# LOCATION 10 SANTA CRUZ ISLAND - YELLOWBANKS
# 1990 SIZE FREQUENCY DISTRIBUTIONS

## Cypraea spadicea

| | |
|---|---|
| (cases) N= | 15 |
| < 30 | 13.3% |
| 30 - 34 | 26.7% |
| 35 - 39 | 20.0% |
| 40 - 44 | 20.0% |
| 45 - 49 | 13.3% |
| 50 - 54 | 6.7% |
| 55 - 59 | 0.0 |
| > 59 | 0.0 |
| min size (mm) | 25 |
| max size (mm) | 51 |
| mean | 38 |
| mode | 34 |

## Kelletia kelletii

| | |
|---|---|
| (cases) N= | 49 |
| < 40 | 0.0 |
| 40 - 49 | 0.0 |
| 50 - 59 | 0.0 |
| 60 - 69 | 0.0 |
| 70 - 79 | 6.1% |
| 80 - 89 | 20.4% |
| 90 - 99 | 34.7% |
| 100 - 109 | 30.6% |
| 110 - 119 | 8.2% |
| 120 - 129 | 0.0 |
| 130 - 139 | 0.0 |
| 140 - 149 | 0.0 |
| > 149 | 0.0 |
| min size (mm) | 77 |
| max size (mm) | 115 |
| mean | 96 |
| mode | 93 |

## Patiria miniata

| | |
|---|---|
| (cases) N= | 29 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 3.4% |
| 30 - 39 | 6.9% |
| 40 - 49 | 6.9% |
| 50 - 59 | 10.3% |
| 60 - 69 | 24.1% |
| 70 - 79 | 31.0% |
| 80 - 89 | 13.8% |
| 90 - 99 | 3.4% |
| > 99 | 0.0 |
| min size (mm) | 22 |
| max size (mm) | 94 |
| mean | 66 |
| mode | 73 |

## Astraea undosa

| | |
|---|---|
| (cases) N= | 55 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 0.0 |
| 30 - 39 | 0.0 |
| 40 - 49 | 3.6% |
| 50 - 59 | 0.0 |
| 60 - 69 | 3.6% |
| 70 - 79 | 7.3% |
| 80 - 89 | 34.5% |
| 90 - 99 | 21.8% |
| 100 - 109 | 20.0% |
| 110 - 119 | 3.6% |
| > 119 | 3.6% |
| min size (mm) | 43 |
| max size (mm) | 134 |
| mean | 92 |
| mode | 87 |

## Megathura crenulata

| | |
|---|---|
| (cases) N= | 36 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 0.0 |
| 30 - 39 | 0.0 |
| 40 - 49 | 0.0 |
| 50 - 59 | 0.0 |
| 60 - 69 | 0.0 |
| 70 - 79 | 8.3% |
| 80 - 89 | 41.7% |
| 90 - 99 | 30.6% |
| 100 - 109 | 11.1% |
| 110 - 119 | 8.3% |
| > 119 | 0.0 |
| min size (mm) | 73 |
| max size (mm) | 112 |
| mean | 91 |
| mode | 90 |

## Parastichopus parvimensis

| | |
|---|---|
| (cases) N= | 43 |
| < 5 | 0.0 |
| 5 - 6 | 0.0 |
| 7 - 8 | 34.9% |
| 9 - 10 | 44.2% |
| 11 - 12 | 14.0% |
| 13 - 14 | 7.0% |
| > 14 | 0.0 |
| min size (cm) | 7 |
| max size (cm) | 14 |
| mean | 9 |
| mode | 9 |

# LOCATION 10 SANTA CRUZ ISLAND - YELLOWBANKS

## Pisaster giganteus

| | |
|---|---|
| (cases) N= | 27 |
| < 20 | 0.0 |
| 20 - 39 | 0.0 |
| 40 - 59 | 14.8% |
| 60 - 79 | 66.7% |
| 80 - 99 | 3.7% |
| 100 - 119 | 0.0 |
| 120 - 139 | 3.7% |
| 140 - 159 | 3.7% |
| 160 - 179 | 0.0 |
| 180 - 199 | 0.0 |
| 200 - 219 | 3.7% |
| 220 - 239 | 3.7% |
| 240 - 259 | 0.0 |
| 260 - 279 | 0.0 |
| 280 - 299 | 0.0 |
| > 299 | 0.0 |
| min size (mm) | 54 |
| max size (mm) | 239 |
| mean | 84 |
| mode | 72 |

## Lytechinus anamesus

| | |
|---|---|
| (cases) N= | 148 |
| < 5 | 0.0 |
| 5 - 9 | 2.7% |
| 10 - 14 | 10.1% |
| 15 - 19 | 23.0% |
| 20 - 24 | 47.3% |
| 25 - 29 | 13.5% |
| 30 - 34 | 3.4% |
| 35 - 39 | 0.0 |
| 40 - 44 | 0.0 |
| 45 - 49 | 0.0 |
| > 49 | 0.0 |
| min size (mm) | 7 |
| max size (mm) | 32 |
| mean | 20 |
| mode | 21 |

## Strongylocentrotus franciscanus

| | |
|---|---|
| (cases) N= | 55 |
| < 5 | 0.0 |
| 5 - 9 | 1.8% |
| 10 - 14 | 0.0 |
| 15 - 19 | 1.8% |
| 20 - 24 | 5.5% |
| 25 - 29 | 3.6% |
| 30 - 34 | 14.5% |
| 35 - 39 | 10.9% |
| 40 - 44 | 3.6% |
| 45 - 49 | 18.2% |
| 50 - 54 | 10.9% |
| 55 - 59 | 1.8% |
| 60 - 64 | 9.1% |
| 65 - 69 | 5.5% |
| 70 - 74 | 1.8% |
| 75 - 79 | 3.6% |
| 80 - 84 | 1.8% |
| 85 - 90 | 1.8% |
| 90 - 94 | 3.6% |
| 95 - 99 | 0.0 |
| 100 - 104 | 0.0 |
| 105 - 109 | 0.0 |
| > 109 | 0.0 |
| min size (mm) | 8 |
| max size (mm) | 94 |
| mean | 48 |
| mode | 38 |

## Strongylocentrotus purpuratus

| | |
|---|---|
| (cases) N= | 118 |
| < 5 | 0.0 |
| 5 - 9 | 5.1% |
| 10 - 14 | 5.1% |
| 15 - 19 | 8.5% |
| 20 - 24 | 14.4% |
| 25 - 29 | 7.6% |
| 30 - 34 | 17.8% |
| 35 - 39 | 9.3% |
| 40 - 44 | 12.7% |
| 45 - 49 | 3.4% |
| 50 - 54 | 10.2% |
| 55 - 59 | 5.1% |
| 60 - 64 | 0.8% |
| 65 - 69 | 0.0 |
| 70 - 74 | 0.0 |
| 75 - 79 | 0.0 |
| 80 - 84 | 0.0 |
| 85 - 90 | 0.0 |
| 90 - 94 | 0.0 |
| 95 - 99 | 0.0 |
| 100 - 104 | 0.0 |
| 105 - 109 | 0.0 |
| > 109 | 0.0 |
| min size (mm) | 5 |
| max size (mm) | 60 |
| mean | 32 |
| mode | 31 |

# LOCATION 10 SANTA CRUZ ISLAND - YELLOWBANKS

*Macrocystis pyrifera* numbers of stipes.

| | |
|---|---|
| (cases) N= | 101 |
| < 3 | 8.9% |
| 3 - 5 | 2.0% |
| 6 - 8 | 2.0% |
| 9 - 11 | 8.9% |
| 12 - 14 | 11.9% |
| 15 - 17 | 14.9% |
| 18 - 20 | 14.9% |
| 21 - 23 | 9.9% |
| 24 - 26 | 7.9% |
| 27 - 29 | 6.9% |
| 30 - 32 | 0.0 |
| 33 - 35 | 5.9% |
| 36 - 38 | 2.0% |
| 39 - 41 | 2.0% |
| 42 - 44 | 1.0% |
| >44 | 1.0% |
| min number | 2 |
| max number | 49 |
| mean | 19 |
| mode | 2 |

*Macrocystis pyrifera* holdfast diameters.

| | |
|---|---|
| (cases) N= | 101 |
| < 6 | 7.9% |
| 6 - 11 | 5.9% |
| 12 - 17 | 10.9% |
| 18 - 23 | 15.8% |
| 24 - 29 | 14.9% |
| 30 - 35 | 17.8% |
| 36 - 41 | 15.8% |
| 42 - 47 | 5.0% |
| 48 - 53 | 5.0% |
| 54 - 59 | 1.0% |
| 60 - 65 | 0.0 |
| 66 - 71 | 0.0 |
| 72 - 77 | 0.0 |
| 78 - 83 | 0.0 |
| 84 - 89 | 0.0 |
| >89 | 0.0 |
| min width (cm) | 4 |
| max width (cm) | 56 |
| mean | 27 |
| mode | 4 |

*Lophogorgia chilensis* heights

| | |
|---|---|
| (cases) N= | 48 |
| < 5 | 0.0 |
| 5 - 8 | 0.0 |
| 9 - 12 | 14.6% |
| 13 - 16 | 8.3% |
| 17 - 20 | 18.8% |
| 21 - 24 | 16.7% |
| 25 - 28 | 16.7% |
| 29 - 32 | 16.7% |
| 33 - 36 | 4.2% |
| 37 - 40 | 4.2% |
| 41 - 44 | 0.0 |
| 45 - 48 | 0.0 |
| 49 - 52 | 0.0 |
| >53 | 0.0 |
| min height (cm) | 9 |
| max height (cm) | 37 |
| mean | 22 |
| mode | 31 |

*Lophogorgia chilensis* widths

| | |
|---|---|
| (cases) N= | 48 |
| < 5 | 2.1% |
| 5 - 8 | 6.3% |
| 9 - 12 | 12.5% |
| 13 - 16 | 22.9% |
| 17 - 20 | 29.2% |
| 21 - 24 | 12.5% |
| 25 - 28 | 4.2% |
| 29 - 32 | 10.4% |
| 33 - 36 | 0.0 |
| 37 - 40 | 0.0 |
| 41 - 44 | 0.0 |
| 45 - 48 | 0.0 |
| 49 - 52 | 0.0 |
| >53 | 0.0 |
| min width (cm) | 4 |
| max width (cm) | 32 |
| mean | 18 |
| mode | 19 |

1990 QUADRAT DATA: MEAN NUMBER PER $M^2$

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Macrocystis pyrifera adult | 0.4500 | 0.6262 | 20 |
| Eisenia arborea | 0.4750 | 0.8656 | 20 |
| Pterygophora californica | 0.0250 | 0.1118 | 20 |
| Laminaria farlowii | 0.4250 | 1.0295 | 20 |
| Macrocystis pyrifera juvenile | 0.0500 | 0.2236 | 20 |
| Macrocystis pyrifera all | 0.5000 | 0.6689 | 20 |
| Cypraea spadicea | 0.3000 | 0.4702 | 20 |
| Astraea undosa | 0.0000 | 0.0000 | 20 |
| Patiria miniata | 0.7000 | 0.7327 | 20 |
| Pisaster giganteus | 0.0000 | 0.0000 | 20 |
| Lytechinus anamesus | 19.6250 | 31.4964 | 20 |
| Strongylocentrotus franciscanus | 7.8500 | 4.3076 | 20 |
| Strongylocentrotus purpuratus | 6.6750 | 5.3096 | 20 |
| Parastichopus parvimensis | 1.5500 | 1.1344 | 20 |
| Styela monteryensis | 0.0000 | 0.0000 | 20 |
| Lythrypnus dalli | 0.0000 | 0.0000 | 20 |
| Coryphopterus nicholsii | 1.0500 | 1.0625 | 20 |
| Alloclinus holderi | 0.0000 | 0.0000 | 20 |

1990 BAND TRANSECT DATA: MEAN NUMBER PER $M^2$

| | | | |
|---|---|---|---|
| Tethya aurantia | 0.0208 | 0.0276 | 12 |
| Allopora californica | 0.0000 | 0.0000 | 12 |
| Tealia lofotensis | 0.0306 | 0.0563 | 12 |
| Lophogorgia chilensis | 0.1056 | 0.0519 | 12 |
| Muricea fruticosa | 0.0125 | 0.0161 | 12 |
| Muricea californica | 0.0181 | 0.0311 | 12 |
| Panulirus interruptus | 0.0014 | 0.0048 | 12 |
| Haliotis rufescens | 0.0042 | 0.0075 | 12 |
| Haliotis corrugata | 0.0319 | 0.0270 | 12 |
| Haliotis fulgens | 0.0014 | 0.0048 | 12 |
| Kelletia kelletii | 0.0056 | 0.0148 | 12 |
| Megathura crenulata | 0.0500 | 0.0466 | 12 |
| Hinnites giganteus | 0.0833 | 0.0508 | 12 |
| Aplysia californica | 0.0028 | 0.0065 | 12 |
| Pycnopodia helianthoides | 0.0000 | 0.0000 | 12 |

LOCATION 11 ANACAPA ISLAND - ADMIRAL'S REEF
1990 RANDOM POINT CONTACT DATA: MEAN PERCENT COVER

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Green algae | 0.8000 | 1.7260 | 25 |
| Miscellaneous brown algae | 5.4000 | 5.8931 | 25 |
| Desmarestia spp. | 0.1000 | 0.5000 | 25 |
| Laminaria farlowii | 2.4000 | 4.9728 | 25 |
| Cystoseira spp. | 3.3000 | 5.7155 | 25 |
| Macrocystis, Eisenia, Pterygophora | 14.7000 | 15.3826 | 25 |
| Miscellaneous red algae | 13.6000 | 10.8513 | 25 |
| Articulated coralline algae | 1.0000 | 1.4434 | 25 |
| Crustose coralline algae | 27.3000 | 10.5060 | 25 |
| Gelidium spp. | 0.3000 | 1.0992 | 25 |
| Gigartina spp. | 0.0000 | 0.0000 | 25 |
| Miscellaneous plants | 0.6000 | 1.8085 | 25 |
| Sponges | 3.2000 | 3.7165 | 25 |
| Corynactis californica | 1.7000 | 3.3634 | 25 |
| Balanophyllia elegans | 1.8000 | 3.1885 | 25 |
| Astrangia lajollaensis | 6.4000 | 4.3946 | 25 |
| Diopatra ornata | 0.2000 | 1.0000 | 25 |
| Phragmatopoma californica | 0.0000 | 0.0000 | 25 |
| Serpulorbis squamigerus | 0.5000 | 1.0206 | 25 |
| Bryozoans, other | 10.8000 | 7.6621 | 25 |
| Diaperoecia californica | 2.8000 | 3.5590 | 25 |
| Tunicates | 4.2000 | 5.2401 | 25 |
| Miscellaneous invertebrates | 29.5000 | 11.6145 | 25 |
| Bare substrate | 10.7000 | 15.7870 | 25 |
| Rock | 83.1000 | 23.0068 | 25 |
| Cobble | 11.0000 | 17.2301 | 25 |
| Sand | 5.9000 | 10.7983 | 25 |

1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| | | | |
|---|---|---|---|
| TOTAL FISH ABUNDANCE | 35.9444 | 149.9654 | 144 |
| Chromis punctipinnis | 415.7500 | 347.2906 | 12 |
| Oxyjulis californica | 4.3333 | 4.1414 | 12 |
| Sebastes mystinus | 4.1667 | 5.5076 | 12 |
| Sebastes serranoides | 0.0000 | 0.0000 | 12 |
| Sebastes atrovirens | 0.2500 | 0.6216 | 12 |
| Paralabrax clathratus | 1.2500 | 1.0553 | 12 |
| Semicossyphus pulcher | 1.2500 | 1.4222 | 12 |
| Embiotoca jacksoni | 0.7500 | 0.6216 | 12 |
| Embiotoca lateralis | 0.0000 | 0.0000 | 12 |
| Damalichthys vacca | 0.4167 | 0.6686 | 12 |
| Hypsypops rubicundus | 1.4167 | 0.7930 | 12 |
| Girella nigricans | 1.7500 | 2.1373 | 12 |

LOCATION 11 ANACAPA ISLAND - ADMIRAL'S REEF
1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| Species | Date (year/month/day) | Mean | Std Dev | Cases |
|---|---|---|---|---|
| Chromis punctipinnis adult | | 30.6667 | 24.9193 | 12 |
| | 900622 | 62.5000 | 12.5565 | 4 |
| | 900927 | 14.7500 | 6.2963 | 8 |
| Chromis punctipinnis juvenile | | 385.0833 | 364.2895 | 12 |
| | 900622 | 5.7500 | 2.5000 | 4 |
| | 900927 | 574.7500 | 291.8888 | 8 |
| Oxyjulis californica adult | | 4.1667 | 4.1960 | 12 |
| | 900622 | 7.2500 | 6.6521 | 4 |
| | 900927 | 2.6250 | 0.7440 | 8 |
| Oxyjulis californica juvenile | | 0.1667 | 0.5774 | 12 |
| | 900622 | 0.0000 | 0.0000 | 4 |
| | 900927 | 0.2500 | 0.7071 | 8 |
| Sebastes mystinus adult | | 0.0000 | 0.0000 | 12 |
| | 900622 | 0.0000 | 0.0000 | 4 |
| | 900927 | 0.0000 | 0.0000 | 8 |
| Sebastes mystinus juvenile | | 4.1667 | 5.5076 | 12 |
| | 900622 | 0.0000 | 0.0000 | 4 |
| | 900927 | 6.2500 | 5.7259 | 8 |
| Sebastes serranoides adult | | 0.0000 | 0.0000 | 12 |
| | 900622 | 0.0000 | 0.0000 | 4 |
| | 900927 | 0.0000 | 0.0000 | 8 |

| | | | |
|---|---|---|---|
| Sebastes serranoides juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900622 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900927 | 0.0000 | 0.0000 |
| 8 | | | |
| Sebastes atrovirens adult | | 0.2500 | 0.6216 |
| 12 | | | |
| | 900622 | 0.7500 | 0.9574 |
| 4 | | | |
| | 900927 | 0.0000 | 0.0000 |
| 8 | | | |
| Sebastes atrovirens juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900622 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900927 | 0.0000 | 0.0000 |
| 8 | | | |
| Paralabrax clathratus adult | | 1.2500 | 1.0553 |
| 12 | | | |
| | 900622 | 1.5000 | 1.2910 |
| 4 | | | |
| | 900927 | 1.1250 | 0.9910 |
| 8 | | | |

| | | | |
|---|---|---|---|
| Paralabrax clathratus juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900622 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900927 | 0.0000 | 0.0000 |
| 8 | | | |
| Semicossyphus pulcher male | | 0.1667 | 0.3892 |
| 12 | | | |
| | 900622 | 0.2500 | 0.5000 |
| 4 | | | |
| | 900927 | 0.1250 | 0.3536 |
| 8 | | | |
| Semicossyphus pulcher female | | 1.0833 | 1.0836 |
| 12 | | | |
| | 900622 | 1.5000 | 1.2910 |
| 4 | | | |
| | 900927 | 0.8750 | 0.9910 |
| 8 | | | |
| Embiotoca jacksoni adult | | 0.7500 | 0.6216 |
| 12 | | | |
| | 900622 | 0.7500 | 0.9574 |
| 4 | | | |
| | 900927 | 0.7500 | 0.4629 |
| 8 | | | |
| Embiotoca jacksoni juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900622 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900927 | 0.0000 | 0.0000 |
| 8 | | | |
| Embiotoca lateralis adult | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900622 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900927 | 0.0000 | 0.0000 |
| 8 | | | |
| Embiotoca lateralis juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900622 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900927 | 0.0000 | 0.0000 |
| 8 | | | |
| Damalichthys vacca adult | | 0.4167 | 0.6686 |
| 12 | | | |
| | 900622 | 0.5000 | 0.5774 |
| 4 | | | |

| | | | |
|---|---|---|---|
| | 900927 | 0.3750 | 0.7440 |
| 8 | | | |
| Damalichthys vacca juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900622 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900927 | 0.0000 | 0.0000 |
| 8 | | | |
| Hypsypops rubicundus adult | | 1.4167 | 0.7930 |
| 12 | | | |
| | 900622 | 1.5000 | 0.5774 |
| 4 | | | |
| | 900927 | 1.3750 | 0.9161 |
| 8 | | | |
| Hypsypops rubicundus juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900622 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900927 | 0.0000 | 0.0000 |
| 8 | | | |
| Girella nigricans adult | | 1.7500 | 2.1373 |
| 12 | | | |
| | 900622 | 3.5000 | 3.0000 |
| 4 | | | |
| | 900927 | 0.8750 | 0.8345 |
| 8 | | | |
| Girella nigricans juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900622 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900927 | 0.0000 | 0.0000 |
| 8 | | | |

## 1990 SIZE FREQUENCY DISTRIBUTIONS

Haliotis corrugata

| | |
|---|---|
| (cases) N= | 27 |
| < 70 | 0.0 |
| 70 - 74 | 0.0 |
| 75 - 79 | 0.0 |
| 80 - 84 | 3.7% |
| 85 - 90 | 0.0 |
| 90 - 94 | 0.0 |
| 95 - 99 | 0.0 |
| 100 - 104 | 3.7% |
| 105 - 109 | 11.1% |
| 110 - 114 | 11.1% |
| 115 - 119 | 11.1% |
| 120 - 124 | 14.8% |
| 125 - 129 | 11.1% |
| 130 - 134 | 3.7% |
| 135 - 139 | 11.1% |
| 140 - 144 | 7.4% |
| 145 - 149 | 7.4% |
| 150 - 154 | 0.0 |
| 155 - 159 | 3.7% |
| 160 - 164 | 0.0 |
| > 165 | 0.0 |
| min size (mm) | 82 |
| max size (mm) | 157 |
| mean | 123 |
| mode | 115 |

Pisaster giganteus

| | |
|---|---|
| (cases) N= | 34 |
| < 20 | 0.0 |
| 20 - 39 | 0.0 |

| | |
|---|---|
| 40 - 59 | 0.0 |
| 60 - 79 | 0.0 |
| 80 - 99 | 5.9% |
| 100 - 119 | 41.2% |
| 120 - 139 | 35.3% |
| 140 - 159 | 8.8% |
| 160 - 179 | 8.8% |
| 180 - 199 | 0.0 |
| 200 - 219 | 0.0 |
| 220 - 239 | 0.0 |
| 240 - 259 | 0.0 |
| 260 - 279 | 0.0 |
| 280 - 299 | 0.0 |
| > 299 | 0.0 |
| min size (mm) | 98 |
| max size (mm) | 174 |
| mean | 125 |
| mode | 107 |

Cypraea spadicea

| | |
|---|---|
| (cases) N= | 56 |
| < 30 | 0.0 |
| 30 - 34 | 12.5% |
| 35 - 39 | 33.9% |
| 40 - 44 | 30.4% |
| 45 - 49 | 17.9% |
| 50 - 54 | 5.4% |
| 55 - 59 | 0.0 |
| > 59 | 0.0 |
| min size (mm) | 31 |
| max size (mm) | 50 |
| mean | 41 |
| mode | 39 |

Kelletia kelletii

| | |
|---|---|
| (cases) N= | 14 |
| < 40 | 0.0 |
| 40 - 49 | 0.0 |
| 50 - 59 | 0.0 |
| 60 - 69 | 0.0 |
| 70 - 79 | 0.0 |
| 80 - 89 | 14.3% |
| 90 - 99 | 21.4% |
| 100 - 109 | 7.1% |
| 110 - 119 | 28.6% |
| 120 - 129 | 28.6% |
| 130 - 139 | 0.0 |
| 140 - 149 | 0.0 |
| > 149 | 0.0 |
| min size (mm) | 88 |
| max size (mm) | 122 |
| mean | 107 |
| mode | 122 |

Lytechinus anamesus

| | |
|---|---|
| (cases) N= | 105 |
| < 5 | 0.0 |
| 5 - 9 | 1.0% |
| 10 - 14 | 0.0 |
| 15 - 19 | 1.0% |
| 20 - 24 | 7.6% |
| 25 - 29 | 60.0% |
| 30 - 34 | 29.5% |
| 35 - 39 | 1.0% |
| 40 - 44 | 0.0 |
| 45 - 49 | 0.0 |
| > 49 | 0.0 |
| min size (mm) | 8 |
| max size (mm) | 35 |
| mean | 28 |
| mode | 29 |

Astraea undosa

| | |
|---|---|
| (cases) N= | 36 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 0.0 |
| 30 - 39 | 0.0 |
| 40 - 49 | 0.0 |
| 50 - 59 | 0.0 |
| 60 - 69 | 5.6% |
| 70 - 79 | 2.8% |
| 80 - 89 | 19.4% |
| 90 - 99 | 22.2% |
| 100 - 109 | 33.3% |
| 110 - 119 | 16.7% |
| > 119 | 0.0 |
| min size (mm) | 67 |
| max size (mm) | 115 |
| mean | 97 |
| mode | 98 |

Megathura crenulata

| | |
|---|---|
| (cases) N= | 12 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 0.0 |
| 30 - 39 | 0.0 |
| 40 - 49 | 0.0 |
| 50 - 59 | 16.7% |
| 60 - 69 | 33.3% |
| 70 - 79 | 33.3% |
| 80 - 89 | 8.3% |
| 90 - 99 | 8.3% |
| 100 - 109 | 0.0 |
| 110 - 119 | 0.0 |
| > 119 | 0.0 |
| min size (mm) | 51 |
| max size (mm) | 92 |
| mean | 69 |
| mode | 61 |

Parastichopus parvimensis

| | |
|---|---|
| (cases) N= | 29 |
| < 5 | 0.0 |
| 5 - 6 | 0.0 |
| 7 - 8 | 3.4% |
| 9 - 10 | 31.0% |
| 11 - 12 | 20.7% |
| 13 - 14 | 34.5% |
| 15 - 16 | 10.3% |
| 17 - 18 | 0.0 |
| > 18 | 0.0 |
| min size (cm) | 8 |
| max size (cm) | 16 |
| mean | 12 |
| mode | 10 |

Hinnites giganteus

| | |
|---|---|
| (cases) N= | 47 |
| < 10 | 0.0 |
| 10 - 19 | 4.3% |
| 20 - 29 | 14.9% |
| 30 - 39 | 21.3% |
| 40 - 49 | 17.0% |
| 50 - 59 | 23.4% |
| 60 - 69 | 12.8% |
| 70 - 79 | 2.1% |
| 80 - 89 | 2.1% |
| 90 - 99 | 2.1% |
| 100 - 109 | 0.0 |
| 110 - 119 | 0.0 |
| 120 - 129 | 0.0 |
| 130 - 139 | 0.0 |
| 140 - 149 | 0.0 |
| > 149 | 0.0 |
| min size (mm) | 18 |
| max size (mm) | 92 |
| mean | 45 |
| mode | 40 |

Patiria miniata

| | |
|---|---|
| (cases) N= | 61 |
| < 10 | 0.0 |
| 10 - 19 | 6.6% |
| 20 - 29 | 1.6% |
| 30 - 39 | 0.0 |
| 40 - 49 | 11.5% |
| 50 - 59 | 27.9% |
| 60 - 69 | 27.9% |
| 70 - 79 | 16.4% |
| 80 - 89 | 6.6% |
| 90 - 99 | 1.6% |
| > 99 | 0.0 |
| min size (mm) | 14 |
| max size (mm) | 93 |
| mean | 59 |
| mode | 42 |

# LOCATION 11 ANACAPA ISLAND - ADMIRAL'S REEF

Strongylocentrotus franciscanus

| | |
|---|---|
| (cases) N= | 97 |
| < 5 | 0.0 |
| 5 - 9 | 0.0 |
| 10 - 14 | 2.1% |
| 15 - 19 | 3.1% |
| 20 - 24 | 1.0% |
| 25 - 29 | 0.0 |
| 30 - 34 | 2.1% |
| 35 - 39 | 1.0% |
| 40 - 44 | 2.1% |
| 45 - 49 | 2.1% |
| 50 - 54 | 5.2% |
| 55 - 59 | 12.4% |
| 60 - 64 | 5.2% |
| 65 - 69 | 11.3% |
| 70 - 74 | 18.6% |
| 75 - 79 | 9.3% |
| 80 - 84 | 8.2% |
| 85 - 90 | 6.2% |
| 90 - 94 | 6.2% |
| 95 - 99 | 1.0% |
| 100 - 104 | 1.0% |
| 105 - 109 | 1.0% |
| > 109 | 1.0% |
| min size (mm) | 11 |
| max size (mm) | 122 |
| mean | 67 |
| mode | 73 |

Strongylocentrotus purpuratus

| | |
|---|---|
| (cases) N= | 117 |
| < 5 | 0.0 |
| 5 - 9 | 1.7% |
| 10 - 14 | 4.3% |
| 15 - 19 | 7.7% |
| 20 - 24 | 11.1% |
| 25 - 29 | 4.3% |
| 30 - 34 | 6.0% |
| 35 - 39 | 11.1% |
| 40 - 44 | 15.4% |
| 45 - 49 | 12.0% |
| 50 - 54 | 15.4% |
| 55 - 59 | 3.4% |
| 60 - 64 | 6.8% |
| 65 - 69 | 0.9% |
| 70 - 74 | 0.0 |
| 75 - 79 | 0.0 |
| 80 - 84 | 0.0 |
| 85 - 90 | 0.0 |
| 90 - 94 | 0.0 |
| 95 - 99 | 0.0 |
| 100 - 104 | 0.0 |
| 105 - 109 | 0.0 |
| > 109 | 0.0 |
| min size (mm) | 7 |
| max size (mm) | 66 |
| mean | 38 |
| mode | 20 |

Macrocystis pyrifera numbers of stipes.

| | |
|---|---|
| (cases) N= | 99 |
| < 3 | 15.2% |
| 3 - 5 | 12.1% |
| 6 - 8 | 15.2% |
| 9 - 11 | 15.2% |
| 12 - 14 | 11.1% |
| 15 - 17 | 11.1% |
| 18 - 20 | 5.1% |
| 21 - 23 | 6.1% |
| 24 - 26 | 2.0% |
| 27 - 29 | 1.0% |
| 30 - 32 | 1.0% |
| 33 - 35 | 2.0% |
| 36 - 38 | 2.0% |
| 39 - 41 | 1.0% |
| 42 - 44 | 0.0 |
| >44 | 0.0 |
| min number | 1 |
| max number | 41 |
| mean | 12 |
| mode | 2 |

Macrocystis pyrifera holdfast diameters.

| | |
|---|---|
| (cases) N= | 99 |
| < 6 | 0.0 |
| 6 - 11 | 18.2% |
| 12 - 17 | 20.2% |
| 18 - 23 | 21.2% |
| 24 - 29 | 14.1% |
| 30 - 35 | 13.1% |
| 36 - 41 | 9.1% |
| 42 - 47 | 3.0% |
| 48 - 53 | 1.0% |
| 54 - 59 | 0.0 |
| 60 - 65 | 0.0 |
| 66 - 71 | 0.0 |
| 72 - 77 | 0.0 |
| 78 - 83 | 0.0 |
| 84 - 89 | 0.0 |
| >89 | 0.0 |
| min width (cm) | 6 |
| max width (cm) | 51 |
| mean | 22 |
| mode | 22 |

## LOCATION 11 ANACAPA ISLAND - ADMIRAL'S REEF

Lophogorgia chilensis widths

| | |
|---|---|
| (cases) N= | 31 |
| < 5 | 0.0 |
| 5 - 8 | 3.2% |
| 9 - 12 | 3.2% |
| 13 - 16 | 12.9% |
| 17 - 20 | 12.9% |
| 21 - 24 | 22.6% |
| 25 - 28 | 12.9% |
| 29 - 32 | 6.5% |
| 33 - 36 | 3.2% |
| 37 - 40 | 0.0 |
| 41 - 44 | 0.0 |
| 45 - 48 | 0.0 |
| 49 - 52 | 0.0 |
| 53 - 56 | 9.7% |
| 57 - 60 | 3.2% |
| 61 - 64 | 3.2% |
| 65 - 68 | 3.2% |
| 69 - 72 | 0.0 |
| 70 - 76 | 0.0 |
| 77 - 80 | 0.0 |
| 81 - 84 | 0.0 |
| 85 - 88 | 3.2% |
| >89 | 0.0 |
| min width (cm) | 8 |
| max width (cm) | 88 |
| mean | 31 |
| mode | 27 |

Muricea californica widths

| | |
|---|---|
| (cases) N= | 30 |
| < 17 | 0.0 |
| 17 - 20 | 3.3% |
| 21 - 24 | 0.0 |
| 25 - 28 | 0.0 |
| 29 - 32 | 3.3% |
| 33 - 36 | 6.7% |
| 37 - 40 | 10.0% |
| 41 - 44 | 3.3% |
| 45 - 48 | 3.3% |
| 49 - 52 | 3.3% |
| 53 - 56 | 10.0% |
| 57 - 60 | 0.0 |
| 61 - 64 | 6.7% |
| 65 - 68 | 0.0 |
| 69 - 72 | 3.3% |
| 73 - 76 | 6.7% |
| 77 - 80 | 6.7% |
| 81 - 84 | 0.0 |
| 85 - 88 | 10.0% |
| 89 - 92 | 6.7% |
| 93 - 96 | 6.7% |
| 97 - 100 | 6.7% |
| >100 | 3.3% |
| min width (cm) | 19 |
| max width (cm) | 107 |
| mean | 66 |
| mode | 38 |

Lophogorgia chilensis heights

| | |
|---|---|
| (cases) N= | 31 |
| < 5 | 3.2% |
| 5 - 8 | 3.2% |
| 9 - 12 | 9.7% |
| 13 - 16 | 9.7% |
| 17 - 20 | 29.0% |
| 21 - 24 | 9.7% |
| 25 - 28 | 9.7% |
| 29 - 32 | 3.2% |
| 33 - 36 | 0.0 |
| 37 - 40 | 0.0 |
| 41 - 44 | 0.0 |
| 45 - 48 | 0.0 |
| 49 - 52 | 9.7% |
| 53 - 56 | 0.0 |
| 57 - 60 | 0.0 |
| 61 - 64 | 3.2% |
| 65 - 68 | 3.2% |
| 69 - 72 | 0.0 |
| 73 - 76 | 6.5% |
| 77 - 80 | 0.0 |
| 81 - 84 | 0.0 |
| 85 - 88 | 0.0 |
| > 88 | 0.0 |
| min height (cm) | 0 |
| max height (cm) | 75 |
| mean | 27 |
| mode | 19 |

Muricea californica heights

| | |
|---|---|
| (cases) N= | 30 |
| < 17 | 0.0 |
| 17 - 20 | 3.3% |
| 21 - 24 | 3.3% |
| 25 - 28 | 6.7% |
| 29 - 32 | 3.3% |
| 33 - 36 | 13.3% |
| 37 - 40 | 6.7% |
| 41 - 44 | 6.7% |
| 45 - 48 | 10.0% |
| 49 - 52 | 6.7% |
| 53 - 56 | 10.0% |
| 57 - 60 | 3.3% |
| 61 - 64 | 6.7% |
| 65 - 68 | 3.3% |
| 69 - 72 | 10.0% |
| 73 - 76 | 0.0 |
| 77 - 80 | 6.7% |
| 81 - 84 | 0.0 |
| 85 - 88 | 0.0 |
| 89 - 92 | 0.0 |
| 93 - 96 | 0.0 |
| 97 - 100 | 0.0 |
| >100 | 0.0 |
| min height (cm) | 17 |
| max height (cm) | 78 |
| mean | 48 |
| mode | 35 |

1990 QUADRAT DATA: MEAN NUMBER PER $M^2$

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Macrocystis pyrifera adult | 0.3500 | 0.8445 | 20 |
| Eisenia arborea | 0.0000 | 0.0000 | 20 |
| Pterygophora californica | 0.0000 | 0.0000 | 20 |
| Laminaria farlowii | 0.1250 | 0.3193 | 20 |
| Macrocystis pyrifera juvenile | 0.9750 | 2.6081 | 20 |
| Macrocystis pyrifera all | 1.3250 | 3.3650 | 20 |
| Cypraea spadicea | 0.0250 | 0.1118 | 20 |
| Astraea undosa | 2.4750 | 1.3325 | 20 |
| Patiria miniata | 0.0000 | 0.0000 | 20 |
| Pisaster giganteus | 0.0000 | 0.0000 | 20 |
| Strongylocentrotus franciscanus | 6.0250 | 4.5407 | 20 |
| Strongylocentrotus purpuratus | 3.1250 | 4.9174 | 20 |
| Parastichopus parvimensis | 1.5500 | 1.2344 | 20 |
| Styela monteryensis | 0.0000 | 0.0000 | 20 |
| Lythrypnus dalli | 0.0000 | 0.0000 | 20 |
| Coryphopterus nicholsii | 1.0250 | 0.7518 | 20 |
| Alloclinus holderi | 0.1000 | 0.2052 | 20 |

1990 BAND TRANSECT DATA: MEAN NUMBER PER $M^2$

| | | | |
|---|---|---|---|
| Tethya aurantia | 0.0042 | 0.0104 | 12 |
| Allopora californica | 0.0000 | 0.0000 | 12 |
| Tealia lofotensis | 0.0000 | 0.0000 | 12 |
| Lophogorgia chilensis | 0.0000 | 0.0000 | 12 |
| Muricea fruticosa | 0.0000 | 0.0000 | 12 |
| Panulirus interruptus | 0.0042 | 0.0075 | 12 |
| Haliotis rufescens | 0.0000 | 0.0000 | 12 |
| Haliotis corrugata | 0.0125 | 0.0226 | 12 |
| Haliotis fulgens | 0.0000 | 0.0000 | 12 |
| Kelletia kelletii | 0.0000 | 0.0000 | 12 |
| Megathura crenulata | 0.0125 | 0.0226 | 12 |
| Hinnites giganteus | 0.1167 | 0.1367 | 12 |
| Aplysia californica | 0.0194 | 0.0264 | 12 |
| Pycnopodia helianthoides | 0.0000 | 0.0000 | 12 |
| Lytechinus anamesus | 0.0000 | 0.0000 | 12 |

LOCATION 12 ANACAPA ISLAND - CATHEDRAL COVE
1990 RANDOM POINT CONTACT DATA: MEAN PERCENT COVER

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Green algae | 9.2000 | 13.0248 | 25 |
| Miscellaneous brown algae | 4.7000 | 6.0947 | 25 |
| Desmarestia spp. | 0.0000 | 0.0000 | 25 |
| Laminaria farlowii | 0.4000 | 1.5612 | 25 |
| Cystoseira spp. | 1.9000 | 3.1689 | 25 |
| Macrocystis, Eisenia, Pterygophora | 9.5000 | 15.7123 | 25 |
| Miscellaneous red algae | 10.1000 | 14.2610 | 25 |
| Articulated coralline algae | 9.0000 | 8.2916 | 25 |
| Crustose coralline algae | 45.1000 | 24.1035 | 25 |
| Gelidium spp. | 0.2000 | 0.6922 | 25 |
| Gigartina spp. | 0.0000 | 0.0000 | 25 |
| Miscellaneous plants | 2.0000 | 5.6366 | 25 |
| Sponges | 0.1000 | 0.5000 | 25 |
| Corynactis californica | 0.1000 | 0.5000 | 25 |
| Balanophyllia elegans | 0.1000 | 0.5000 | 25 |
| Astrangia lajollaensis | 1.7000 | 2.3629 | 25 |
| Diopatra ornata | 0.9000 | 1.7500 | 25 |
| Phragmatopoma californica | 0.3000 | 0.8292 | 25 |
| Serpulorbis squamigerus | 4.0000 | 4.5644 | 25 |
| Bryozoans, other | 1.2000 | 2.8062 | 25 |
| Diaperoecia californica | 0.1000 | 0.5000 | 25 |
| Tunicates | 2.1000 | 2.6693 | 25 |
| Miscellaneous invertebrates | 14.8000 | 9.7340 | 25 |
| Bare substrate | 24.6000 | 22.0638 | 25 |
| Rock | 58.2000 | 25.7747 | 25 |
| Cobble | 14.5000 | 11.8145 | 25 |
| Sand | 27.3000 | 25.4841 | 25 |

1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| | | | |
|---|---|---|---|
| TOTAL FISH ABUNDANCE | 55.9792 | 196.7206 | 144 |
| Chromis punctipinnis | 613.5833 | 362.3488 | 12 |
| Oxyjulis californica | 24.0000 | 26.8768 | 12 |
| Sebastes mystinus | 2.5000 | 1.5076 | 12 |
| Sebastes serranoides | 2.4167 | 2.6785 | 12 |
| Sebastes atrovirens | 0.0833 | 0.2887 | 12 |
| Paralabrax clathratus | 8.1667 | 3.5633 | 12 |
| Semicossyphus pulcher | 11.5000 | 21.3435 | 12 |
| Embiotoca jacksoni | 3.1667 | 1.9924 | 12 |
| Embiotoca lateralis | 0.0000 | 0.0000 | 12 |
| Damalichthys vacca | 0.1667 | 0.3892 | 12 |
| Hypsypops rubicundus | 4.4167 | 1.3790 | 12 |
| Girella nigricans | 1.7500 | 1.5448 | 12 |

LOCATION 12 ANACAPA ISLAND - CATHEDRAL COVE
1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| Species | Date (year/month/day) | Mean | Std Dev | Cases |
|---|---|---|---|---|
| Chromis punctipinnis adult | | 12.0000 | 15.7596 | 12 |
| | 900821 | 7.0000 | 2.1602 | 4 |
| | 900914 | 14.5000 | 19.1535 | 8 |
| Chromis punctipinnis juvenile | | 601.5833 | 360.8400 | 12 |
| | 900821 | 176.0000 | 151.1203 | 4 |
| | 900914 | 814.3750 | 198.9335 | 8 |
| Oxyjulis californica adult | | 2.4167 | 1.7299 | 12 |
| | 900821 | 1.2500 | 1.2583 | 4 |
| | 900914 | 3.0000 | 1.6903 | 8 |
| Oxyjulis californica juvenile | | 21.5833 | 27.5366 | 12 |
| | 900821 | 51.2500 | 17.5000 | 4 |
| | 900914 | 6.7500 | 17.4908 | 8 |
| Sebastes mystinus adult | | 0.0000 | 0.0000 | 12 |
| | 900821 | 0.0000 | 0.0000 | 4 |
| | 900914 | 0.0000 | 0.0000 | 8 |
| Sebastes mystinus juvenile | | 2.5000 | 1.5076 | 12 |
| | 900821 | 4.0000 | 0.0000 | 4 |
| | 900914 | 1.7500 | 1.2817 | 8 |
| Sebastes serranoides adult | | 0.0000 | 0.0000 | 12 |
| | 900821 | 0.0000 | 0.0000 | 4 |
| | 900914 | 0.0000 | 0.0000 | 8 |

| | | | |
|---|---|---|---|
| Sebastes serranoides juvenile | | 2.4167 | 2.6785 |
| 12 | | | |
| | 900821 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900914 | 3.6250 | 2.5036 |
| 8 | | | |
| Sebastes atrovirens adult | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900821 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900914 | 0.0000 | 0.0000 |
| 8 | | | |
| Sebastes atrovirens juvenile | | 0.0833 | 0.2887 |
| 12 | | | |
| | 900821 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900914 | 0.1250 | 0.3536 |
| 8 | | | |
| Paralabrax clathratus adult | | 5.9167 | 2.8749 |
| 12 | | | |
| | 900821 | 7.5000 | 3.1091 |
| 4 | | | |
| | 900914 | 5.1250 | 2.5877 |
| 8 | | | |

| | | | |
|---|---|---|---|
| Paralabrax clathratus juvenile | | 2.2500 | 1.8153 |
| 12 | | | |
| | 900821 | 3.0000 | 1.6330 |
| 4 | | | |
| | 900914 | 1.8750 | 1.8851 |
| 8 | | | |
| Semicossyphus pulcher male | | 1.1667 | 0.9374 |
| 12 | | | |
| | 900821 | 2.0000 | 0.8165 |
| 4 | | | |
| | 900914 | 0.7500 | 0.7071 |
| 8 | | | |
| Semicossyphus pulcher female | | 10.3333 | 21.4321 |
| 12 | | | |
| | 900821 | 2.0000 | 2.1602 |
| 4 | | | |
| | 900914 | 14.5000 | 25.6960 |
| 8 | | | |
| Embiotoca jacksoni adult | | 2.3333 | 2.1462 |
| 12 | | | |
| | 900821 | 4.5000 | 1.2910 |
| 4 | | | |
| | 900914 | 1.2500 | 1.5811 |
| 8 | | | |
| Embiotoca jacksoni juvenile | | 0.8333 | 1.5859 |
| 12 | | | |
| | 900821 | 0.2500 | 0.5000 |
| 4 | | | |
| | 900914 | 1.1250 | 1.8851 |
| 8 | | | |
| Embiotoca lateralis adult | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900821 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900914 | 0.0000 | 0.0000 |
| 8 | | | |
| Embiotoca lateralis juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900821 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900914 | 0.0000 | 0.0000 |
| 8 | | | |
| Damalichthys vacca adult | | 0.1667 | 0.3892 |
| 12 | | | |
| | 900821 | 0.0000 | 0.0000 |
| 4 | | | |

| | | | |
|---|---|---|---|
| | 900914 | 0.2500 | 0.4629 |
| 8 | | | |
| Damalichthys vacca juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900821 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900914 | 0.0000 | 0.0000 |
| 8 | | | |
| Hypsypops rubicundus adult | | 4.4167 | 1.3790 |
| 12 | | | |
| | 900821 | 5.2500 | 1.5000 |
| 4 | | | |
| | 900914 | 4.0000 | 1.1952 |
| 8 | | | |
| Hypsypops rubicundus juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900821 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900914 | 0.0000 | 0.0000 |
| 8 | | | |
| Girella nigricans adult | | 1.5833 | 1.3790 |
| 12 | | | |
| | 900821 | 2.2500 | 0.9574 |
| 4 | | | |
| | 900914 | 1.2500 | 1.4880 |
| 8 | | | |
| Girella nigricans juvenile | | 0.1667 | 0.5774 |
| 12 | | | |
| | 900821 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900914 | 0.2500 | 0.7071 |
| 8 | | | |

# LOCATION 12 ANACAPA ISLAND - CATHEDRAL COVE
# 1990 SIZE FREQUENCY DISTRIBUTIONS

## Haliotis corrugata

| | |
|---|---|
| (cases) N= | 8 |
| < 60 | 0.0 |
| 60 - 64 | 0.0 |
| 65 - 69 | 0.0 |
| 70 - 74 | 0.0 |
| 75 - 79 | 0.0 |
| 80 - 84 | 12.5% |
| 85 - 90 | 0.0 |
| 90 - 94 | 0.0 |
| 95 - 99 | 0.0 |
| 100 - 104 | 0.0 |
| 105 - 109 | 0.0 |
| 110 - 114 | 0.0 |
| 115 - 119 | 0.0 |
| 120 - 124 | 0.0 |
| 125 - 129 | 12.5% |
| 130 - 134 | 0.0 |
| 135 - 139 | 12.5% |
| 140 - 144 | 25.0% |
| 145 - 149 | 12.5% |
| 150 - 154 | 0.0 |
| 155 - 159 | 0.0 |
| 160 - 164 | 0.0 |
| 165 - 169 | 0.0 |
| 170 - 174 | 12.5% |
| 175 - 179 | 12.5% |
| 180 - 184 | 0.0 |
| 185 - 189 | 0.0 |
| > 189 | 0.0 |
| min size (mm) | 84 |
| max size (mm) | 177 |
| mean | 141 |
| mode | 84 |

## Parastichopus parvimensis

| | |
|---|---|
| (cases) N= | 61 |
| < 7 | 0.0 |
| 7 - 8 | 4.9% |
| 9 - 10 | 23.0% |
| 11 - 12 | 42.6% |
| 13 - 14 | 19.7% |
| 15 - 16 | 6.6% |
| 17 - 18 | 3.3% |
| > 18 | 0.0 |
| min size (cm) | 7 |
| max size (cm) | 17 |
| mean | 12 |
| mode | 12 |

## Cypraea spadicea

| | |
|---|---|
| (cases) N= | 32 |
| < 30 | 0.0 |
| 30 - 34 | 6.3% |
| 35 - 39 | 25.0% |
| 40 - 44 | 43.8% |
| 45 - 49 | 12.5% |
| 50 - 54 | 9.4% |
| 55 - 59 | 3.1% |
| > 59 | 0.0 |
| min size (mm) | 33 |
| max size (mm) | 59 |
| mean | 42 |
| mode | 41 |

## Astraea undosa

| | |
|---|---|
| (cases) N= | 28 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 0.0 |
| 30 - 39 | 14.3% |
| 40 - 49 | 17.9% |
| 50 - 59 | 25.0% |
| 60 - 69 | 25.0% |
| 70 - 79 | 14.3% |
| 80 - 89 | 3.6% |
| 90 - 99 | 0.0 |
| 100 - 109 | 0.0 |
| 110 - 119 | 0.0 |
| > 119 | 0.0 |
| min size (mm) | 36 |
| max size (mm) | 81 |
| mean | 57 |
| mode | 39 |

## Megathura crenulata

| | |
|---|---|
| (cases) N= | 16 |
| < 10 | 0.0 |
| 10 - 19 | 31.3% |
| 20 - 29 | 6.3% |
| 30 - 39 | 0.0 |
| 40 - 49 | 0.0 |
| 50 - 59 | 12.5% |
| 60 - 69 | 25.0% |
| 70 - 79 | 18.8% |
| 80 - 89 | 6.3% |
| 90 - 99 | 0.0 |
| 100 - 109 | 0.0 |
| > 109 | 0.0 |
| min size (mm) | 14 |
| max size (mm) | 87 |
| mean | 50 |
| mode | 14 |

## Hinnites giganteus

| | |
|---|---|
| (cases) N= | 51 |
| < 10 | 0.0 |

| | |
|---|---|
| 10 - 19 | 0.0 |
| 20 - 29 | 0.0 |
| 30 - 39 | 2.0% |
| 40 - 49 | 11.8% |
| 50 - 59 | 7.8% |
| 60 - 69 | 31.4% |
| 70 - 79 | 17.6% |
| 80 - 89 | 13.7% |
| 90 - 99 | 7.8% |
| 100 - 109 | 2.0% |
| 110 - 119 | 5.9% |
| 120 - 129 | 0.0 |
| 130 - 139 | 0.0 |
| 140 - 149 | 0.0 |
| > 149 | 0.0 |
| min size (mm) | 35 |
| max size (mm) | 117 |
| mean | 71 |
| mode | 64 |

Patiria miniata

| | |
|---|---|
| (cases) N= | 28 |
| < 10 | 35.7% |
| 10 - 19 | 42.9% |
| 20 - 29 | 7.1% |
| 30 - 39 | 7.1% |
| 40 - 49 | 3.6% |
| 50 - 59 | 0.0 |
| 60 - 69 | 3.6% |
| 70 - 79 | 0.0 |
| 80 - 89 | 0.0 |
| 90 - 99 | 0.0 |
| > 99 | 0.0 |
| min size (mm) | 5 |
| max size (mm) | 68 |
| mean | 17 |
| mode | 8 |

Strongylocentrotus franciscanus

| | |
|---|---|
| (cases) N= | 86 |
| < 5 | 1.2% |
| 5 - 9 | 0.0 |
| 10 - 14 | 0.0 |
| 15 - 19 | 1.2% |
| 20 - 24 | 0.0 |
| 25 - 29 | 0.0 |
| 30 - 34 | 2.3% |
| 35 - 39 | 3.5% |
| 40 - 44 | 4.7% |
| 45 - 49 | 2.3% |
| 50 - 54 | 4.7% |
| 55 - 59 | 4.7% |
| 60 - 64 | 4.7% |
| 65 - 69 | 7.0% |
| 70 - 74 | 9.3% |
| 75 - 79 | 11.6% |
| 80 - 84 | 8.1% |
| 85 - 90 | 5.8% |
| 90 - 94 | 7.0% |
| 95 - 99 | 12.8% |
| 100 - 104 | 2.3% |
| 105 - 109 | 3.5% |
| > 109 | 3.5% |
| min size (mm) | 4 |
| max size (mm) | 120 |
| mean | 74 |
| mode | 76 |

Strongylocentrotus purpuratus

| | |
|---|---|
| (cases) N= | 126 |
| < 5 | 1.6% |
| 5 - 9 | 3.2% |
| 10 - 14 | 4.8% |
| 15 - 19 | 8.7% |
| 20 - 24 | 8.7% |
| 25 - 29 | 8.7% |
| 30 - 34 | 7.1% |
| 35 - 39 | 11.1% |
| 40 - 44 | 19.0% |
| 45 - 49 | 15.9% |
| 50 - 54 | 8.7% |
| 55 - 59 | 2.4% |
| 60 - 64 | 0.0 |
| 65 - 69 | 0.0 |
| 70 - 74 | 0.0 |
| 75 - 79 | 0.0 |
| 80 - 84 | 0.0 |
| 85 - 90 | 0.0 |
| 90 - 94 | 0.0 |
| 95 - 99 | 0.0 |
| 100 - 104 | 0.0 |
| 105 - 109 | 0.0 |
| > 109 | 0.0 |
| min size (mm) | 3 |
| max size (mm) | 58 |
| mean | 34 |
| mode | 42 |

Macrocystis pyrifera numbers of stipes.

| | |
|---|---|
| (cases) N= | 102 |
| < 3 | 32.4% |
| 3 - 5 | 29.4% |
| 6 - 8 | 11.8% |
| 9 - 11 | 10.8% |
| 12 - 14 | 2.9% |
| 15 - 17 | 1.0% |
| 18 - 20 | 4.9% |
| 21 - 23 | 1.0% |
| 24 - 26 | 2.0% |
| 27 - 29 | 1.0% |
| 30 - 32 | 2.0% |
| 33 - 35 | 0.0 |
| 36 - 38 | 0.0 |
| 39 - 41 | 0.0 |
| 42 - 44 | 1.0% |
| >44 | 0.0 |
| min number | 1 |
| max number | 43 |
| mean | 7 |
| mode | 2 |

Macrocystis pyrifera holdfast diameters.

| | |
|---|---|
| (cases) N= | 102 |
| < 6 | 5.9% |
| 6 - 11 | 26.5% |
| 12 - 17 | 31.4% |
| 18 - 23 | 14.7% |
| 24 - 29 | 11.8% |
| 30 - 35 | 7.8% |
| 36 - 41 | 1.0% |
| 42 - 47 | 1.0% |
| 48 - 53 | 0.0 |
| 54 - 59 | 0.0 |
| 60 - 65 | 0.0 |
| 66 - 71 | 0.0 |
| 72 - 77 | 0.0 |
| 78 - 83 | 0.0 |
| 84 - 89 | 0.0 |
| >89 | 0.0 |
| min width (cm) | 2 |
| max width (cm) | 43 |
| mean | 16 |
| mode | 14 |

1990 QUADRAT DATA: MEAN NUMBER PER $M^2$

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Macrocystis pyrifera adult | 0.4750 | 0.5495 | 20 |
| Eisenia arborea | 0.5750 | 0.9358 | 20 |
| Pterygophora californica | 0.4000 | 1.0834 | 20 |
| Laminaria farlowii | 2.2750 | 2.3026 | 20 |
| Macrocystis pyrifera juvenile | 0.7250 | 0.6584 | 20 |
| Macrocystis pyrifera all | 1.2000 | 1.0311 | 20 |
| Cypraea spadicea | 0.0500 | 0.1539 | 20 |
| Astraea undosa | 1.0500 | 1.7911 | 20 |
| Patiria miniata | 0.0000 | 0.0000 | 20 |
| Pisaster giganteus | 0.0250 | 0.1118 | 20 |
| Strongylocentrotus franciscanus | 1.2500 | 1.6975 | 20 |
| Strongylocentrotus purpuratus | 0.5750 | 1.0036 | 20 |
| Parastichopus parvimensis | 0.7000 | 1.0438 | 20 |
| Styela monteryensis | 0.0750 | 0.1832 | 20 |
| Lythrypnus dalli | 0.2250 | 0.7340 | 20 |
| Coryphopterus nicholsii | 0.2750 | 0.5250 | 20 |
| Alloclinus holderi | 0.0750 | 0.1832 | 20 |

1990 BAND TRANSECT DATA: MEAN NUMBER PER $M^2$

| | | | |
|---|---|---|---|
| Tethya aurantia | 0.0014 | 0.0048 | 12 |
| Allopora californica | 0.0000 | 0.0000 | 12 |
| Tealia lofotensis | 0.0000 | 0.0000 | 12 |
| Lophogorgia chilensis | 0.0028 | 0.0065 | 12 |
| Muricea fruticosa | 0.0000 | 0.0000 | 12 |
| Panulirus interruptus | 0.0111 | 0.0192 | 12 |
| Haliotis rufescens | 0.0014 | 0.0048 | 12 |
| Haliotis corrugata | 0.0306 | 0.0324 | 12 |
| Haliotis fulgens | 0.0000 | 0.0000 | 12 |
| Kelletia kelletii | 0.0000 | 0.0000 | 12 |
| Megathura crenulata | 0.0292 | 0.0176 | 12 |
| Hinnites giganteus | 0.7764 | 0.5322 | 12 |
| Aplysia californica | 0.0042 | 0.0104 | 12 |
| Pycnopodia helianthoides | 0.0000 | 0.0000 | 12 |
| Lytechinus anamesus | 0.0000 | 0.0000 | 12 |

LOCATION 13 ANACAPA ISLAND - LANDING COVE
1990 RANDOM POINT CONTACT DATA: MEAN PERCENT COVER

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Green algae | 9.3000 | 11.9138 | 25 |
| Miscellaneous brown algae | 3.0000 | 3.6084 | 25 |
| Desmarestia spp. | 0.0000 | 0.0000 | 25 |
| Laminaria farlowii | 29.8000 | 34.0643 | 25 |
| Cystoseira spp. | 5.1000 | 7.4470 | 25 |
| Macrocystis, Eisenia, Pterygophora | 52.1000 | 26.2071 | 25 |
| Miscellaneous red algae | 22.5000 | 19.9870 | 25 |
| Articulated coralline algae | 30.5000 | 21.5421 | 25 |
| Crustose coralline algae | 41.7000 | 20.9752 | 25 |
| Gelidium spp. | 20.8000 | 33.4922 | 25 |
| Gigartina spp. | 0.5000 | 1.2500 | 25 |
| Miscellaneous plants | 0.9000 | 2.3805 | 25 |
| Sponges | 6.8000 | 7.8899 | 25 |
| Corynactis californica | 3.9000 | 5.9983 | 25 |
| Balanophyllia elegans | 0.2000 | 0.6922 | 25 |
| Astrangia lajollaensis | 1.8000 | 2.9333 | 25 |
| Diopatra ornata | 0.6000 | 1.4930 | 25 |
| Phragmatopoma californica | 0.0000 | 0.0000 | 25 |
| Serpulorbis squamigerus | 3.0000 | 3.3072 | 25 |
| Bryozoans, other | 12.7000 | 14.0668 | 25 |
| Diaperoecia californica | 7.2000 | 9.2792 | 25 |
| Tunicates | 1.5000 | 2.8868 | 25 |
| Miscellaneous invertebrates | 18.0000 | 18.4983 | 25 |
| Bare substrate | 13.1000 | 18.8646 | 25 |
| Rock | 80.0000 | 25.1143 | 25 |
| Cobble | 4.5000 | 6.2500 | 25 |
| Sand | 15.5000 | 22.5693 | 25 |

1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| | | | |
|---|---|---|---|
| TOTAL FISH ABUNDANCE | 14.7222 | 75.0927 | 144 |
| Chromis punctipinnis | 161.9167 | 217.9034 | 12 |
| Oxyjulis californica | 1.5833 | 2.1088 | 12 |
| Sebastes mystinus | 0.0000 | 0.0000 | 12 |
| Sebastes serranoides | 0.3333 | 1.1547 | 12 |
| Sebastes atrovirens | 0.1667 | 0.3892 | 12 |
| Paralabrax clathratus | 3.8333 | 1.6422 | 12 |
| Semicossyphus pulcher | 1.5000 | 1.0871 | 12 |
| Embiotoca jacksoni | 0.9167 | 1.2401 | 12 |
| Embiotoca lateralis | 0.0000 | 0.0000 | 12 |
| Damalichthys vacca | 0.0000 | 0.0000 | 12 |
| Hypsypops rubicundus | 3.7500 | 1.8153 | 12 |
| Girella nigricans | 2.6667 | 0.9847 | 12 |

LOCATION 13 ANACAPA ISLAND - LANDING COVE
1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| Species | Date (year/month/day) | Mean | Std Dev | Cases |
|---|---|---|---|---|
| Chromis punctipinnis adult | | 17.2500 | 23.0498 | 12 |
| | 900820 | 44.2500 | 20.2382 | 4 |
| | 900927 | 3.7500 | 5.8737 | 8 |
| Chromis punctipinnis juvenile | | 144.6667 | 203.2331 | 12 |
| | 900820 | 363.5000 | 228.0256 | 4 |
| | 900927 | 35.2500 | 39.6872 | 8 |
| Oxyjulis californica adult | | 1.4167 | 1.9287 | 12 |
| | 900820 | 1.0000 | 1.1547 | 4 |
| | 900927 | 1.6250 | 2.2638 | 8 |
| Oxyjulis californica juvenile | | 0.1667 | 0.3892 | 12 |
| | 900820 | 0.0000 | 0.0000 | 4 |
| | 900927 | 0.2500 | 0.4629 | 8 |
| Sebastes mystinus adult | | 0.0000 | 0.0000 | 12 |
| | 900820 | 0.0000 | 0.0000 | 4 |
| | 900927 | 0.0000 | 0.0000 | 8 |
| Sebastes mystinus juvenile | | 0.0000 | 0.0000 | 12 |
| | 900820 | 0.0000 | 0.0000 | 4 |
| | 900927 | 0.0000 | 0.0000 | 8 |
| Sebastes serranoides adult | | 0.1667 | 0.5774 | 12 |
| | 900820 | 0.0000 | 0.0000 | 4 |
| | 900927 | 0.2500 | 0.7071 | 8 |

| | | | |
|---|---|---|---|
| Sebastes serranoides juvenile | | 0.1667 | 0.5774 |
| 12 | | | |
| | 900820 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900927 | 0.2500 | 0.7071 |
| 8 | | | |
| Sebastes atrovirens adult | | 0.1667 | 0.3892 |
| 12 | | | |
| | 900820 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900927 | 0.2500 | 0.4629 |
| 8 | | | |
| Sebastes atrovirens juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900820 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900927 | 0.0000 | 0.0000 |
| 8 | | | |
| Paralabrax clathratus adult | | 2.5833 | 1.4434 |
| 12 | | | |
| | 900820 | 2.0000 | 1.6330 |
| 4 | | | |
| | 900927 | 2.8750 | 1.3562 |
| 8 | | | |

| | | | |
|---|---|---|---|
| Paralabrax clathratus juvenile | | 1.2500 | 1.0553 |
| 12 | | | |
| | 900820 | 1.2500 | 0.5000 |
| 4 | | | |
| | 900927 | 1.2500 | 1.2817 |
| 8 | | | |
| Semicossyphus pulcher male | | 0.3333 | 0.4924 |
| 12 | | | |
| | 900820 | 0.2500 | 0.5000 |
| 4 | | | |
| | 900927 | 0.3750 | 0.5175 |
| 8 | | | |
| Semicossyphus pulcher female | | 1.1667 | 1.1934 |
| 12 | | | |
| | 900820 | 1.7500 | 1.5000 |
| 4 | | | |
| | 900927 | 0.8750 | 0.9910 |
| 8 | | | |
| Embiotoca jacksoni adult | | 0.9167 | 1.2401 |
| 12 | | | |
| | 900820 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900927 | 1.3750 | 1.3025 |
| 8 | | | |
| Embiotoca jacksoni juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900820 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900927 | 0.0000 | 0.0000 |
| 8 | | | |
| Embiotoca lateralis adult | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900820 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900927 | 0.0000 | 0.0000 |
| 8 | | | |
| Embiotoca lateralis juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900820 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900927 | 0.0000 | 0.0000 |
| 8 | | | |
| Damalichthys vacca adult | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900820 | 0.0000 | 0.0000 |
| 4 | | | |

| | | | |
|---|---|---|---|
| | 900927 | 0.0000 | 0.0000 |
| 8 | | | |
| Damalichthys vacca juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900820 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900927 | 0.0000 | 0.0000 |
| 8 | | | |
| Hypsypops rubicundus adult | | 3.7500 | 1.8153 |
| 12 | | | |
| | 900820 | 4.2500 | 2.0616 |
| 4 | | | |
| | 900927 | 3.5000 | 1.7728 |
| 8 | | | |
| Hypsypops rubicundus juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900820 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900927 | 0.0000 | 0.0000 |
| 8 | | | |
| Girella nigricans adult | | 2.5833 | 0.9962 |
| 12 | | | |
| | 900820 | 3.0000 | 1.1547 |
| 4 | | | |
| | 900927 | 2.3750 | 0.9161 |
| 8 | | | |
| Girella nigricans juvenile | | 0.0833 | 0.2887 |
| 12 | | | |
| | 900820 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900927 | 0.1250 | 0.3536 |
| 8 | | | |

# LOCATION 13 ANACAPA ISLAND - LANDING COVE
# 1990 SIZE FREQUENCY DISTRIBUTIONS

## Haliotis corrugata

| | |
|---|---|
| (cases) N= | 46 |
| < 25 | 0.0 |
| 25 - 29 | 0.0 |
| 30 - 34 | 2.2% |
| 35 - 39 | 0.0 |
| 40 - 44 | 2.2% |
| 45 - 49 | 0.0 |
| 50 - 54 | 0.0 |
| 55 - 59 | 0.0 |
| 60 - 64 | 0.0 |
| 65 - 69 | 0.0 |
| 70 - 74 | 0.0 |
| 75 - 79 | 0.0 |
| 80 - 84 | 0.0 |
| 85 - 90 | 0.0 |
| 90 - 94 | 0.0 |
| 95 - 99 | 0.0 |
| 100 - 104 | 0.0 |
| 105 - 109 | 0.0 |
| 110 - 114 | 2.2% |
| 115 - 119 | 0.0 |
| 120 - 124 | 2.2% |
| 125 - 129 | 6.5% |
| 130 - 134 | 8.7% |
| 135 - 139 | 6.5% |
| 140 - 144 | 13.0% |
| 145 - 149 | 13.0% |
| 150 - 154 | 10.9% |
| 155 - 159 | 8.7% |
| 160 - 164 | 15.2% |
| 165 - 169 | 6.5% |
| 170 - 174 | 2.2% |
| 175 - 179 | 0.0 |
| > 179 | 0.0 |
| min size (mm) | 34 |
| max size (mm) | 174 |
| mean | 143 |
| mode | 152 |

## Parastichopus parvimensis

| | |
|---|---|
| (cases) N= | 50 |
| < 5 | 6.0% |
| 5 - 6 | 0.0 |
| 7 - 8 | 16.0% |
| 9 - 10 | 18.0% |
| 11 - 12 | 30.0% |
| 13 - 14 | 22.0% |
| 15 - 16 | 6.0% |
| 17 - 18 | 2.0% |
| > 18 | 0.0 |
| min size (cm) | 2 |
| max size (cm) | 17 |
| mean | 11 |
| mode | 12 |

## Astraea undosa

| | |
|---|---|
| (cases) N= | 45 |
| < 10 | 0.0 |
| 10 - 19 | 2.2% |
| 20 - 29 | 0.0 |
| 30 - 39 | 8.9% |
| 40 - 49 | 11.1% |
| 50 - 59 | 13.3% |
| 60 - 69 | 20.0% |
| 70 - 79 | 17.8% |
| 80 - 89 | 22.2% |
| 90 - 99 | 4.4% |
| 100 - 109 | 0.0 |
| 110 - 119 | 0.0 |
| > 119 | 0.0 |
| min size (mm) | 18 |
| max size (mm) | 91 |
| mean | 64 |
| mode | 58 |

## Hinnites giganteus

| | |
|---|---|
| (cases) N= | 55 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 0.0 |
| 30 - 39 | 9.1% |
| 40 - 49 | 18.2% |
| 50 - 59 | 5.5% |
| 60 - 69 | 16.4% |
| 70 - 79 | 10.9% |
| 80 - 89 | 16.4% |
| 90 - 99 | 9.1% |
| 100 - 109 | 7.3% |
| 110 - 119 | 7.3% |
| 120 - 129 | 0.0 |
| 130 - 139 | 0.0 |
| 140 - 149 | 0.0 |
| > 149 | 0.0 |
| min size (mm) | 30 |
| max size (mm) | 115 |
| mean | 71 |
| mode | 47 |

Strongylocentrotus franciscanus

| | |
|---|---|
| (cases) N= | 92 |
| < 5 | 0.0 |
| 5 - 9 | 0.0 |
| 10 - 14 | 0.0 |
| 15 - 19 | 0.0 |
| 20 - 24 | 2.2% |
| 25 - 29 | 7.6% |
| 30 - 34 | 5.4% |
| 35 - 39 | 0.0 |
| 40 - 44 | 1.1% |
| 45 - 49 | 0.0 |
| 50 - 54 | 2.2% |
| 55 - 59 | 2.2% |
| 60 - 64 | 1.1% |
| 65 - 69 | 5.4% |
| 70 - 74 | 4.3% |
| 75 - 79 | 4.3% |
| 80 - 84 | 12.0% |
| 85 - 90 | 8.7% |
| 90 - 94 | 7.6% |
| 95 - 99 | 3.3% |
| 100 - 104 | 9.8% |
| 105 - 109 | 5.4% |
| > 109 | 16.3% |
| min size (mm) | 20 |
| max size (mm) | 133 |
| mean | 82 |
| mode | 91 |

Strongylocentrotus purpuratus

| | |
|---|---|
| (cases) N= | 68 |
| < 5 | 0.0 |
| 5 - 9 | 5.9% |
| 10 - 14 | 4.4% |
| 15 - 19 | 10.3% |
| 20 - 24 | 8.8% |
| 25 - 29 | 13.2% |
| 30 - 34 | 8.8% |
| 35 - 39 | 13.2% |
| 40 - 44 | 10.3% |
| 45 - 49 | 13.2% |
| 50 - 54 | 5.9% |
| 55 - 59 | 2.9% |
| 60 - 64 | 1.5% |
| 65 - 69 | 1.5% |
| 70 - 74 | 0.0 |
| 75 - 79 | 0.0 |
| 80 - 84 | 0.0 |
| 85 - 90 | 0.0 |
| 90 - 94 | 0.0 |
| 95 - 99 | 0.0 |
| 100 - 104 | 0.0 |
| 105 - 109 | 0.0 |
| > 109 | 0.0 |
| min size (mm) | 6 |
| max size (mm) | 67 |
| mean | 33 |
| mode | 38 |

Macrocystis pyrifera numbers of stipes.

| | |
|---|---|
| (cases) N= | 103 |
| < 3 | 47.6% |
| 3 - 5 | 16.5% |
| 6 - 8 | 8.7% |
| 9 - 11 | 3.9% |
| 12 - 14 | 4.9% |
| 15 - 17 | 2.9% |
| 18 - 20 | 5.8% |
| 21 - 23 | 1.9% |
| 24 - 26 | 1.0% |
| 27 - 29 | 1.0% |
| 30 - 32 | 4.9% |
| 33 - 35 | 0.0 |
| 36 - 38 | 1.0% |
| 39 - 41 | 0.0 |
| 42 - 44 | 0.0 |
| >44 | 0.0 |
| min number | 1 |
| max number | 37 |
| mean | 7 |
| mode | 2 |

Macrocystis pyrifera holdfast diameters.

| | |
|---|---|
| (cases) N= | 103 |
| < 6 | 21.4% |
| 6 - 11 | 37.9% |
| 12 - 17 | 7.8% |
| 18 - 23 | 9.7% |
| 24 - 29 | 3.9% |
| 30 - 35 | 9.7% |
| 36 - 41 | 7.8% |
| 42 - 47 | 1.9% |
| 48 - 53 | 0.0 |
| 54 - 59 | 0.0 |
| 60 - 65 | 0.0 |
| 66 - 71 | 0.0 |
| 72 - 77 | 0.0 |
| 78 - 83 | 0.0 |
| 84 - 89 | 0.0 |
| >89 | 0.0 |
| min width (cm) | 3 |
| max width (cm) | 47 |
| mean | 15 |
| mode | 6 |

1990 QUADRAT DATA: MEAN NUMBER PER $M^2$

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Macrocystis pyrifera adult | 0.0000 | 0.0000 | 20 |
| Eisenia arborea | 0.0000 | 0.0000 | 20 |
| Pterygophora californica | 0.0000 | 0.0000 | 20 |
| Laminaria farlowii | 0.0000 | 0.0000 | 20 |
| Macrocystis pyrifera juvenile | 0.0250 | 0.1118 | 20 |
| Macrocystis pyrifera all | 0.0250 | 0.1118 | 20 |
| Cypraea spadicea | 0.0750 | 0.2447 | 20 |
| Astraea undosa | 0.2250 | 0.4128 | 20 |
| Patiria miniata | 0.2750 | 0.4128 | 20 |
| Pisaster giganteus | 0.1250 | 0.2221 | 20 |
| Strongylocentrotus franciscanus | 1.2750 | 1.4732 | 20 |
| Strongylocentrotus purpuratus | 77.5250 | 40.8352 | 20 |
| Parastichopus parvimensis | 1.3000 | 0.9090 | 20 |
| Styela monteryensis | 0.0000 | 0.0000 | 20 |
| Lythrypnus dalli | 0.0000 | 0.0000 | 20 |
| Coryphopterus nicholsii | 1.1750 | 1.0915 | 20 |
| Alloclinus holderi | 0.5750 | 0.5911 | 20 |

1990 BAND TRANSECT DATA: MEAN NUMBER PER $M^2$

| | | | |
|---|---|---|---|
| Tethya aurantia | 0.1056 | 0.0538 | 12 |
| Allopora californica | 0.0000 | 0.0000 | 12 |
| Tealia lofotensis | 0.0000 | 0.0000 | 12 |
| Lophogorgia chilensis | 0.2083 | 0.0665 | 12 |
| Muricea fruticosa | 0.0125 | 0.0176 | 12 |
| Muricea californica | 0.0278 | 0.0205 | 12 |
| Panulirus interruptus | 0.0000 | 0.0000 | 12 |
| Haliotis rufescens | 0.0000 | 0.0000 | 12 |
| Haliotis corrugata | 0.0014 | 0.0048 | 12 |
| Haliotis fulgens | 0.0000 | 0.0000 | 12 |
| Kelletia kelletii | 0.0000 | 0.0000 | 12 |
| Megathura crenulata | 0.0000 | 0.0000 | 12 |
| Hinnites giganteus | 0.0042 | 0.0104 | 12 |
| Aplysia californica | 0.0694 | 0.0375 | 12 |
| Pycnopodia helianthoides | 0.0000 | 0.0000 | 12 |
| Lytechinus anamesus | 12.3139 | 6.9813 | 12 |

1990 RANDOM POINT CONTACT DATA: MEAN PERCENT COVER

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Green algae | 0.3000 | 0.8292 | 25 |
| Miscellaneous brown algae | 0.0000 | 0.0000 | 25 |
| Desmarestia spp. | 0.0000 | 0.0000 | 25 |
| Laminaria farlowii | 0.0000 | 0.0000 | 25 |
| Cystoseira spp. | 0.0000 | 0.0000 | 25 |
| Macrocystis, Eisenia, Pterygophora | 0.0000 | 0.0000 | 25 |
| Miscellaneous red algae | 3.3000 | 3.2048 | 25 |
| Articulated coralline algae | 1.4000 | 1.9203 | 25 |
| Crustose coralline algae | 29.5000 | 12.5000 | 25 |
| Gelidium spp. | 0.0000 | 0.0000 | 25 |
| Gigartina spp. | 0.0000 | 0.0000 | 25 |
| Miscellaneous plants | 0.0000 | 0.0000 | 25 |
| Sponges | 1.0000 | 1.2500 | 25 |
| Corynactis californica | 2.5000 | 5.3522 | 25 |
| Balanophyllia elegans | 6.1000 | 8.7226 | 25 |
| Astrangia lajollaensis | 4.0000 | 4.0182 | 25 |
| Diopatra ornata | 0.0000 | 0.0000 | 25 |
| Phragmatopoma californica | 0.0000 | 0.0000 | 25 |
| Serpulorbis squamigerus | 0.0000 | 0.0000 | 25 |
| Bryozoans, other | 3.6000 | 4.8455 | 25 |
| Diaperoecia californica | 0.2000 | 0.6922 | 25 |
| Tunicates | 2.8000 | 2.5331 | 25 |
| Miscellaneous invertebrates | 14.6000 | 7.2053 | 25 |
| Bare substrate | 34.4000 | 15.2971 | 25 |
| Rock | 78.2000 | 25.7140 | 25 |
| Cobble | 8.1000 | 10.4652 | 25 |
| Sand | 13.7000 | 20.7304 | 25 |

1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| | | | |
|---|---|---|---|
| TOTAL FISH ABUNDANCE | 4.3056 | 13.1225 | 144 |
| Chromis punctipinnis | 43.2500 | 18.5086 | 12 |
| Oxyjulis californica | 5.3333 | 7.7381 | 12 |
| Sebastes mystinus | 0.0000 | 0.0000 | 12 |
| Sebastes serranoides | 0.0000 | 0.0000 | 12 |
| Sebastes atrovirens | 0.0000 | 0.0000 | 12 |
| Paralabrax clathratus | 1.5000 | 1.3143 | 12 |
| Semicossyphus pulcher | 0.5000 | 0.9045 | 12 |
| Embiotoca jacksoni | 0.0000 | 0.0000 | 12 |
| Embiotoca lateralis | 0.0000 | 0.0000 | 12 |
| Damalichthys vacca | 0.0000 | 0.0000 | 12 |
| Hypsypops rubicundus | 1.0833 | 0.7930 | 12 |
| Girella nigricans | 0.0000 | 0.0000 | 12 |

LOCATION 14 SANTA BARBARA ISLAND - SOUTHEAST SEA LION ROOKERY
1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| Species | Date (year/month/day) | Mean | Std Dev | Cases |
|---|---|---|---|---|
| Chromis punctipinnis adult | | 30.7500 | 13.8638 | 12 |
| | 900619 | 35.5000 | 8.8129 | 4 |
| | 900822 | 28.3750 | 15.7927 | 8 |
| Chromis punctipinnis juvenile | | 12.5000 | 17.2653 | 12 |
| | 900619 | 0.0000 | 0.0000 | 4 |
| | 900822 | 18.7500 | 18.2893 | 8 |
| Oxyjulis californica adult | | 1.5833 | 3.2039 | 12 |
| | 900619 | 4.2500 | 4.7871 | 4 |
| | 900822 | 0.2500 | 0.4629 | 8 |
| Oxyjulis californica juvenile | | 3.7500 | 7.6530 | 12 |
| | 900619 | 0.5000 | 1.0000 | 4 |
| | 900822 | 5.3750 | 9.0859 | 8 |
| Sebastes mystinus adult | | 0.0000 | 0.0000 | 12 |
| | 900619 | 0.0000 | 0.0000 | 4 |
| | 900822 | 0.0000 | 0.0000 | 8 |
| Sebastes mystinus juvenile | | 0.0000 | 0.0000 | 12 |
| | 900619 | 0.0000 | 0.0000 | 4 |
| | 900822 | 0.0000 | 0.0000 | 8 |
| Sebastes serranoides adult | | 0.0000 | 0.0000 | 12 |
| | 900619 | 0.0000 | 0.0000 | 4 |
| | 900822 | 0.0000 | 0.0000 | 8 |

| | | | |
|---|---|---|---|
| Sebastes serranoides juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900619 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900822 | 0.0000 | 0.0000 |
| 8 | | | |
| Sebastes atrovirens adult | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900619 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900822 | 0.0000 | 0.0000 |
| 8 | | | |
| Sebastes atrovirens juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900619 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900822 | 0.0000 | 0.0000 |
| 8 | | | |
| Paralabrax clathratus adult | | 1.5000 | 1.3143 |
| 12 | | | |
| | 900619 | 0.5000 | 0.5774 |
| 4 | | | |
| | 900822 | 2.0000 | 1.3093 |
| 8 | | | |

| | | | |
|---|---|---|---|
| Paralabrax clathratus juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900619 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900822 | 0.0000 | 0.0000 |
| 8 | | | |
| Semicossyphus pulcher male | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900619 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900822 | 0.0000 | 0.0000 |
| 8 | | | |
| Semicossyphus pulcher female | | 0.5000 | 0.9045 |
| 12 | | | |
| | 900619 | 1.2500 | 1.2583 |
| 4 | | | |
| | 900822 | 0.1250 | 0.3536 |
| 8 | | | |
| Embiotoca jacksoni adult | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900619 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900822 | 0.0000 | 0.0000 |
| 8 | | | |
| Embiotoca jacksoni juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900619 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900822 | 0.0000 | 0.0000 |
| 8 | | | |
| Embiotoca lateralis adult | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900619 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900822 | 0.0000 | 0.0000 |
| 8 | | | |
| Embiotoca lateralis juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900619 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900822 | 0.0000 | 0.0000 |
| 8 | | | |
| Damalichthys vacca adult | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900619 | 0.0000 | 0.0000 |
| 4 | | | |

| | | | |
|---|---|---|---|
| | 900822 | 0.0000 | 0.0000 |
| 8 | | | |
| Damalichthys vacca juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900619 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900822 | 0.0000 | 0.0000 |
| 8 | | | |
| Hypsypops rubicundus adult | | 1.0833 | 0.7930 |
| 12 | | | |
| | 900619 | 1.2500 | 0.9574 |
| 4 | | | |
| | 900822 | 1.0000 | 0.7559 |
| 8 | | | |
| Hypsypops rubicundus juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900619 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900822 | 0.0000 | 0.0000 |
| 8 | | | |
| Girella nigricans adult | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900619 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900822 | 0.0000 | 0.0000 |
| 8 | | | |
| Girella nigricans juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900619 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900822 | 0.0000 | 0.0000 |
| 8 | | | |

1990 SIZE FREQUENCY DISTRIBUTIONS

Tethya aurantia

| | |
|---|---|
| (cases) N= | 30 |
| < 10 | 0.0 |
| 10 - 19 | 10.0% |
| 20 - 29 | 6.7% |
| 30 - 39 | 3.3% |
| 40 - 49 | 6.7% |
| 50 - 59 | 16.7% |
| 60 - 69 | 40.0% |
| 70 - 79 | 6.7% |
| 80 - 89 | 0.0 |
| 90 - 99 | 10.0% |
| > 99 | 0.0 |
| min size (mm) | 16 |
| max size (mm) | 97 |
| mean | 57 |
| mode | 65 |

Haliotis fulgens

| | |
|---|---|
| (cases) N= | 3 |
| < 25 | 66.7% |
| 25 - 29 | 33.3% |
| 30 - 34 | 0.0 |
| 35 - 39 | 0.0 |
| 40 - 44 | 0.0 |
| 45 - 49 | 0.0 |
| >50 | 0.0 |
| min size (mm) | 0 |
| max size (mm) | 28 |
| mean | 17 |
| mode | 22 |

Astraea undosa

| | |
|---|---|
| (cases) N= | 25 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 4.0% |
| 30 - 39 | 4.0% |
| 40 - 49 | 16.0% |
| 50 - 59 | 8.0% |
| 60 - 69 | 60.0% |
| 70 - 79 | 8.0% |
| 80 - 89 | 0.0 |
| 90 - 99 | 0.0 |
| 100 - 109 | 0.0 |
| 110 - 119 | 0.0 |
| > 119 | 0.0 |
| min size (mm) | 26 |
| max size (mm) | 71 |
| mean | 59 |
| mode | 61 |

Patiria miniata

| | |
|---|---|
| (cases) N= | 52 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 3.8% |
| 30 - 39 | 21.2% |
| 40 - 49 | 21.2% |
| 50 - 59 | 23.1% |
| 60 - 69 | 19.2% |
| 70 - 79 | 7.7% |
| 80 - 89 | 3.8% |
| 90 - 99 | 0.0 |
| > 99 | 0.0 |
| min size (mm) | 20 |
| max size (mm) | 89 |
| mean | 51 |
| mode | 42 |

Pisaster giganteus

| | |
|---|---|
| (cases) N= | 44 |
| < 20 | 0.0 |
| 20 - 39 | 2.3% |
| 40 - 59 | 4.5% |
| 60 - 79 | 22.7% |
| 80 - 99 | 50.0% |
| 100 - 119 | 15.9% |
| 120 - 139 | 2.3% |
| 140 - 159 | 2.3% |
| 160 - 179 | 0.0 |
| 180 - 199 | 0.0 |
| 200 - 219 | 0.0 |
| 220 - 239 | 0.0 |
| 240 - 259 | 0.0 |
| 260 - 279 | 0.0 |
| 280 - 299 | 0.0 |
| > 299 | 0.0 |
| min size (mm) | 37 |
| max size (mm) | 151 |
| mean | 87 |
| mode | 85 |

Lytechinus anamesus

| | |
|---|---|
| (cases) N= | 108 |
| < 5 | 0.0 |
| 5 - 9 | 0.0 |
| 10 - 14 | 43.5% |
| 15 - 19 | 54.6% |
| 20 - 24 | 1.9% |
| 25 - 29 | 0.0 |
| 30 - 34 | 0.0 |
| 35 - 39 | 0.0 |
| 40 - 44 | 0.0 |
| 45 - 49 | 0.0 |
| > 49 | 0.0 |
| min size (mm) | 10 |
| max size (mm) | 23 |
| mean | 15 |
| mode | 15 |

Strongylocentrotus franciscanus

| | |
|---|---|
| (cases) N= | 100 |
| < 5 | 0.0 |
| 5 - 9 | 0.0 |
| 10 - 14 | 2.0% |
| 15 - 19 | 9.0% |
| 20 - 24 | 40.0% |
| 25 - 29 | 12.0% |
| 30 - 34 | 1.0% |
| 35 - 39 | 2.0% |
| 40 - 44 | 0.0 |
| 45 - 49 | 0.0 |
| 50 - 54 | 0.0 |
| 55 - 59 | 0.0 |
| 60 - 64 | 0.0 |
| 65 - 69 | 2.0% |
| 70 - 74 | 0.0 |
| 75 - 79 | 7.0% |
| 80 - 84 | 6.0% |
| 85 - 90 | 6.0% |
| 90 - 94 | 6.0% |
| 95 - 99 | 4.0% |
| 100 - 104 | 2.0% |
| 105 - 109 | 1.0% |
| > 109 | 0.0 |
| min size (mm) | 14 |
| max size (mm) | 105 |
| mean | 44 |
| mode | 21 |

Strongylocentrotus purpuratus

| | |
|---|---|
| (cases) N= | 106 |
| < 5 | 0.0 |
| 5 - 9 | 1.9% |
| 10 - 14 | 58.5% |
| 15 - 19 | 28.3% |
| 20 - 24 | 9.4% |
| 25 - 29 | 1.9% |
| 30 - 34 | 0.0 |
| 35 - 39 | 0.0 |
| 40 - 44 | 0.0 |
| 45 - 49 | 0.0 |
| 50 - 54 | 0.0 |
| 55 - 59 | 0.0 |
| 60 - 64 | 0.0 |
| 65 - 69 | 0.0 |
| 70 - 74 | 0.0 |
| 75 - 79 | 0.0 |
| 80 - 84 | 0.0 |
| 85 - 90 | 0.0 |
| 90 - 94 | 0.0 |
| 95 - 99 | 0.0 |
| 100 - 104 | 0.0 |
| 105 - 109 | 0.0 |
| > 109 | 0.0 |
| min size (mm) | 9 |
| max size (mm) | 27 |
| mean | 15 |
| mode | 13 |

Parastichopus parvimensis

| | |
|---|---|
| (cases) N= | 31 |
| < 5 | 0.0 |
| 5 - 6 | 3.2% |
| 7 - 8 | 16.1% |
| 9 - 10 | 25.8% |
| 11 - 12 | 38.7% |
| 13 - 14 | 16.1% |
| 15 - 16 | 0.0 |
| 17 - 18 | 0.0 |
| 19 - 20 | 0.0 |
| 21 - 22 | 0.0 |
| > 22 | 0.0 |
| min size (cm) | 6 |
| max size (cm) | 14 |
| mean | 10 |
| mode | 11 |

Lophogorgia chilensis widths

| | |
|---|---|
| (cases) N= | 37 |
| < 5 | 2.7% |
| 5 - 8 | 2.7% |
| 9 - 12 | 16.2% |
| 13 - 16 | 10.8% |
| 17 - 20 | 18.9% |
| 21 - 24 | 10.8% |
| 25 - 28 | 5.4% |
| 29 - 32 | 8.1% |
| 33 - 36 | 5.4% |
| 37 - 40 | 2.7% |
| 41 - 44 | 2.7% |
| 45 - 48 | 0.0 |
| 49 - 52 | 5.4% |
| 53 - 56 | 0.0 |
| 57 - 60 | 5.4% |
| 61 - 64 | 0.0 |
| 65 - 68 | 2.7% |
| >69 | 0.0 |
| min width (cm) | 4 |
| max width (cm) | 65 |
| mean | 25 |
| mode | 20 |

Muricea californica widths

| | |
|---|---|
| (cases) N= | 31 |
| < 5 | 0.0 |
| 5 - 8 | 0.0 |
| 9 - 12 | 0.0 |
| 13 - 16 | 0.0 |
| 17 - 20 | 0.0 |
| 21 - 24 | 0.0 |
| 25 - 28 | 0.0 |
| 29 - 32 | 0.0 |
| 33 - 36 | 6.5% |
| 37 - 40 | 9.7% |
| 41 - 44 | 3.2% |
| 45 - 48 | 3.2% |
| 49 - 52 | 3.2% |
| 53 - 56 | 6.5% |
| 57 - 60 | 6.5% |
| 61 - 64 | 6.5% |
| 65 - 68 | 3.2% |
| 69 - 72 | 6.5% |
| 73 - 76 | 0.0 |
| 77 - 80 | 9.7% |
| 81 - 84 | 6.5% |
| 85 - 88 | 3.2% |
| 89 - 92 | 0.0 |
| 93 - 96 | 3.2% |
| 97 - 100 | 9.7% |
| >100 | 12.9% |
| min width (cm) | 35 |
| max width (cm) | 113 |
| mean | 70 |
| mode | 97 |

Lophogorgia chilensis heights

| | |
|---|---|
| (cases) N= | 37 |
| < 5 | 0.0 |
| 5 - 8 | 2.7% |
| 9 - 12 | 8.1% |
| 13 - 16 | 13.5% |
| 17 - 20 | 16.2% |
| 21 - 24 | 10.8% |
| 25 - 28 | 8.1% |
| 29 - 32 | 8.1% |
| 33 - 36 | 10.8% |
| 37 - 40 | 0.0 |
| 41 - 44 | 8.1% |
| 45 - 48 | 5.4% |
| 49 - 52 | 5.4% |
| 53 - 56 | 0.0 |
| 57 - 60 | 0.0 |
| 61 - 64 | 2.7% |
| 65 - 68 | 0.0 |
| >69 | 0.0 |
| min height (cm) | 5 |
| max height (cm) | 61 |
| mean | 27 |
| mode | 12 |

Muricea californica heights

| | |
|---|---|
| (cases) N= | 31 |
| < 5 | 0.0 |
| 5 - 8 | 0.0 |
| 9 - 12 | 0.0 |
| 13 - 16 | 0.0 |
| 17 - 20 | 3.2% |
| 21 - 24 | 9.7% |
| 25 - 28 | 9.7% |
| 29 - 32 | 0.0 |
| 33 - 36 | 9.7% |
| 37 - 40 | 3.2% |
| 41 - 44 | 0.0 |
| 45 - 48 | 19.4% |
| 49 - 52 | 12.9% |
| 53 - 56 | 16.1% |
| 57 - 60 | 6.5% |
| 61 - 64 | 3.2% |
| 65 - 68 | 0.0 |
| 69 - 72 | 0.0 |
| 73 - 76 | 3.2% |
| 77 - 80 | 0.0 |
| 81 - 84 | 0.0 |
| 85 - 88 | 0.0 |
| 89 - 92 | 0.0 |
| 93 - 96 | 0.0 |
| 97 - 100 | 0.0 |
| >100 | 3.2% |
| min height (cm) | 18 |
| max height (cm) | 110 |
| mean | 46 |
| mode | 46 |

1990 QUADRAT DATA: MEAN NUMBER PER $M^2$

| Species | MEAN | STD DEV | CASE |
|---|---|---|---|
| Macrocystis pyrifera adult | 0.0000 | 0.0000 | 20 |
| Eisenia arborea | 0.0000 | 0.0000 | 20 |
| Pterygophora californica | 0.0000 | 0.0000 | 20 |
| Laminaria farlowii | 0.0250 | 0.1118 | 20 |
| Macrocystis pyrifera juvenile | 0.0000 | 0.0000 | 20 |
| Macrocystis pyrifera all | 0.0000 | 0.0000 | 20 |
| Cypraea spadicea | 0.1000 | 0.2052 | 20 |
| Astraea undosa | 0.7250 | 0.9662 | 20 |
| Patiria miniata | 0.0000 | 0.0000 | 20 |
| Pisaster giganteus | 0.1250 | 0.2751 | 20 |
| Strongylocentrotus franciscanus | 1.7000 | 1.7199 | 20 |
| Strongylocentrotus purpuratus | 66.5250 | 32.5574 | 20 |
| Parastichopus parvimensis | 0.3750 | 0.5590 | 20 |
| Styela monteryensis | 0.0000 | 0.0000 | 20 |
| Lythrypnus dalli | 0.0000 | 0.0000 | 20 |
| Coryphopterus nicholsii | 0.2750 | 0.4128 | 20 |
| Alloclinus holderi | 0.7000 | 0.7504 | 20 |

1990 BAND TRANSECT DATA: MEAN NUMBER PER $M^2$

| | | | |
|---|---|---|---|
| Tethya aurantia | 0.0000 | 0.0000 | 12 |
| Allopora californica | 0.0000 | 0.0000 | 12 |
| Tealia lofotensis | 0.0000 | 0.0000 | 12 |
| Lophogorgia chilensis | 0.0000 | 0.0000 | 12 |
| Muricea fruticosa | 0.0000 | 0.0000 | 12 |
| Muricea californica | 0.0000 | 0.0000 | 12 |
| Panulirus interruptus | 0.0056 | 0.0082 | 12 |
| Haliotis rufescens | 0.0000 | 0.0000 | 12 |
| Haliotis corrugata | 0.0000 | 0.0000 | 12 |
| Haliotis fulgens | 0.0000 | 0.0000 | 12 |
| Kelletia kelletii | 0.0000 | 0.0000 | 12 |
| Megathura crenulata | 0.0000 | 0.0000 | 12 |
| Hinnites giganteus | 0.0014 | 0.0048 | 12 |
| Aplysia californica | 0.1236 | 0.0793 | 12 |
| Pycnopodia helianthoides | 0.0000 | 0.0000 | 12 |
| Lytechinus anamesus | 0.0403 | 0.0505 | 12 |

LOCATION 15 SANTA BARBARA ISLAND - ARCH POINT
1990 RANDOM POINT CONTACT DATA: MEAN PERCENT COVER

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Green algae | 2.4000 | 3.0173 | 25 |
| Miscellaneous brown algae | 4.2000 | 4.8261 | 25 |
| Desmarestia spp. | 0.0000 | 0.0000 | 25 |
| Laminaria farlowii | 0.0000 | 0.0000 | 25 |
| Cystoseira spp. | 0.0000 | 0.0000 | 25 |
| Macrocystis, Eisenia, Pterygophora | 2.4000 | 7.6879 | 25 |
| Miscellaneous red algae | 15.7000 | 10.2956 | 25 |
| Articulated coralline algae | 9.3000 | 16.1135 | 25 |
| Crustose coralline algae | 36.3000 | 15.5309 | 25 |
| Gelidium spp. | 0.0000 | 0.0000 | 25 |
| Gigartina spp. | 0.0000 | 0.0000 | 25 |
| Miscellaneous plants | 2.3000 | 3.0551 | 25 |
| Sponges | 0.0000 | 0.0000 | 25 |
| Corynactis californica | 7.3000 | 7.8369 | 25 |
| Balanophyllia elegans | 0.3000 | 0.8292 | 25 |
| Astrangia lajollaensis | 1.3000 | 2.1794 | 25 |
| Diopatra ornata | 0.0000 | 0.0000 | 25 |
| Phragmatopoma californica | 0.0000 | 0.0000 | 25 |
| Serpulorbis squamigerus | 0.4000 | 1.1815 | 25 |
| Bryozoans, other | 3.1000 | 4.4651 | 25 |
| Diaperoecia californica | 0.0000 | 0.0000 | 25 |
| Tunicates | 0.3000 | 1.0992 | 25 |
| Miscellaneous invertebrates | 8.2000 | 4.8153 | 25 |
| Bare substrate | 21.6000 | 11.1074 | 25 |
| Rock | 83.3000 | 12.0269 | 25 |
| Cobble | 10.0000 | 9.8160 | 25 |
| Sand | 6.7000 | 7.8965 | 25 |

1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| | | | |
|---|---|---|---|
| TOTAL FISH ABUNDANCE | 17.4028 | 53.0097 | 144 |
| Chromis punctipinnis | 158.5833 | 102.7578 | 12 |
| Oxyjulis californica | 25.0000 | 39.0478 | 12 |
| Sebastes mystinus | 0.0000 | 0.0000 | 12 |
| Sebastes serranoides | 0.0000 | 0.0000 | 12 |
| Sebastes atrovirens | 0.0000 | 0.0000 | 12 |
| Paralabrax clathratus | 3.2500 | 2.6328 | 12 |
| Semicossyphus pulcher | 1.0000 | 1.3484 | 12 |
| Embiotoca jacksoni | 0.2500 | 0.4523 | 12 |
| Embiotoca lateralis | 0.0000 | 0.0000 | 12 |
| Damalichthys vacca | 0.0833 | 0.2887 | 12 |
| Hypsypops rubicundus | 7.9167 | 2.0652 | 12 |
| Girella nigricans | 12.7500 | 4.7697 | 12 |

LOCATION 15 SANTA BARBARA ISLAND - ARCH POINT
1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| Species | Date (year/month/day) | Mean | Std Dev | Cases |
|---|---|---|---|---|
| Chromis punctipinnis adult | | 21.1667 | 37.4938 | 12 |
| | 900619 | 62.5000 | 41.6693 | 4 |
| | 900823 | 0.5000 | 0.7559 | 8 |
| Chromis punctipinnis juvenile | | 137.4167 | 123.9409 | 12 |
| | 900619 | 0.0000 | 0.0000 | 4 |
| | 900823 | 206.1250 | 89.1827 | 8 |
| Oxyjulis californica adult | | 24.5833 | 39.3064 | 12 |
| | 900619 | 70.5000 | 37.9693 | 4 |
| | 900823 | 1.6250 | 1.6850 | 8 |
| Oxyjulis californica juvenile | | 0.4167 | 1.4434 | 12 |
| | 900619 | 0.0000 | 0.0000 | 4 |
| | 900823 | 0.6250 | 1.7678 | 8 |
| Sebastes mystinus adult | | 0.0000 | 0.0000 | 12 |
| | 900619 | 0.0000 | 0.0000 | 4 |
| | 900823 | 0.0000 | 0.0000 | 8 |
| Sebastes mystinus juvenile | | 0.0000 | 0.0000 | 12 |
| | 900619 | 0.0000 | 0.0000 | 4 |
| | 900823 | 0.0000 | 0.0000 | 8 |
| Sebastes serranoides adult | | 0.0000 | 0.0000 | 12 |
| | 900619 | 0.0000 | 0.0000 | 4 |
| | 900823 | 0.0000 | 0.0000 | 8 |

| | | | |
|---|---|---|---|
| Sebastes serranoides juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900619 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900823 | 0.0000 | 0.0000 |
| 8 | | | |
| Sebastes atrovirens adult | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900619 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900823 | 0.0000 | 0.0000 |
| 8 | | | |
| Sebastes atrovirens juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900619 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900823 | 0.0000 | 0.0000 |
| 8 | | | |
| Paralabrax clathratus adult | | 3.0833 | 2.6785 |
| 12 | | | |
| | 900619 | 0.5000 | 1.0000 |
| 4 | | | |
| | 900823 | 4.3750 | 2.2638 |
| 8 | | | |

| | | | |
|---|---|---|---|
| Paralabrax clathratus juvenile | | 0.1667 | 0.3892 |
| 12 | | | |
| | 900619 | 0.2500 | 0.5000 |
| 4 | | | |
| | 900823 | 0.1250 | 0.3536 |
| 8 | | | |
| Semicossyphus pulcher male | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900619 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900823 | 0.0000 | 0.0000 |
| 8 | | | |
| Semicossyphus pulcher female | | 1.0000 | 1.3484 |
| 12 | | | |
| | 900619 | 0.7500 | 0.9574 |
| 4 | | | |
| | 900823 | 1.1250 | 1.5526 |
| 8 | | | |
| Embiotoca jacksoni adult | | 0.2500 | 0.4523 |
| 12 | | | |
| | 900619 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900823 | 0.3750 | 0.5175 |
| 8 | | | |
| Embiotoca jacksoni juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900619 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900823 | 0.0000 | 0.0000 |
| 8 | | | |
| Embiotoca lateralis adult | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900619 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900823 | 0.0000 | 0.0000 |
| 8 | | | |
| Embiotoca lateralis juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900619 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900823 | 0.0000 | 0.0000 |
| 8 | | | |
| Damalichthys vacca adult | | 0.0833 | 0.2887 |
| 12 | | | |
| | 900619 | 0.2500 | 0.5000 |
| 4 | | | |

| | | | |
|---|---|---|---|
| | 900823 | 0.0000 | 0.0000 |
| 8 | | | |
| Damalichthys vacca juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900619 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900823 | 0.0000 | 0.0000 |
| 8 | | | |
| Hypsypops rubicundus adult | | 7.9167 | 2.0652 |
| 12 | | | |
| | 900619 | 6.0000 | 0.8165 |
| 4 | | | |
| | 900823 | 8.8750 | 1.8077 |
| 8 | | | |
| Hypsypops rubicundus juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900619 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900823 | 0.0000 | 0.0000 |
| 8 | | | |
| Girella nigricans adult | | 12.7500 | 4.7697 |
| 12 | | | |
| | 900619 | 8.5000 | 4.9329 |
| 4 | | | |
| | 900823 | 14.8750 | 3.1368 |
| 8 | | | |
| Girella nigricans juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900619 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900823 | 0.0000 | 0.0000 |
| 8 | | | |

# LOCATION 15 SANTA BARBARA ISLAND - ARCH POINT
# 1990 SIZE FREQUENCY DISTRIBUTIONS

## Cypraea spadicea

| | |
|---|---|
| (cases) N= | 27 |
| < 30 | 0.0 |
| 30 - 34 | 18.5% |
| 35 - 39 | 33.3% |
| 40 - 44 | 40.7% |
| 45 - 49 | 7.4% |
| 50 - 54 | 0.0 |
| 55 - 59 | 0.0 |
| > 59 | 0.0 |
| min size (mm) | 32 |
| max size (mm) | 47 |
| mean | 39 |
| mode | 38 |

## Astraea undosa

| | |
|---|---|
| (cases) N= | 60 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 0.0 |
| 30 - 39 | 5.0% |
| 40 - 49 | 1.7% |
| 50 - 59 | 3.3% |
| 60 - 69 | 43.3% |
| 70 - 79 | 33.3% |
| 80 - 89 | 11.7% |
| 90 - 99 | 1.7% |
| 100 - 109 | 0.0 |
| 110 - 119 | 0.0 |
| > 119 | 0.0 |
| min size (mm) | 31 |
| max size (mm) | 95 |
| mean | 68 |
| mode | 70 |

## Patiria miniata

| | |
|---|---|
| (cases) N= | 24 |
| < 10 | 0.0 |
| 10 - 19 | 20.8% |
| 20 - 29 | 16.7% |
| 30 - 39 | 8.3% |
| 40 - 49 | 16.7% |
| 50 - 59 | 20.8% |
| 60 - 69 | 8.3% |
| 70 - 79 | 4.2% |
| 80 - 89 | 0.0 |
| 90 - 99 | 4.2% |
| > 99 | 0.0 |
| min size (mm) | 12 |
| max size (mm) | 92 |
| mean | 40 |
| mode | 12 |

## Pisaster giganteus

| | |
|---|---|
| (cases) N= | 50 |
| < 20 | 0.0 |
| 20 - 39 | 0.0 |
| 40 - 59 | 2.0% |
| 60 - 79 | 4.0% |
| 80 - 99 | 26.0% |
| 100 - 119 | 34.0% |
| 120 - 139 | 18.0% |
| 140 - 159 | 8.0% |
| 160 - 179 | 2.0% |
| 180 - 199 | 4.0% |
| 200 - 219 | 2.0% |
| 220 - 239 | 0.0 |
| 240 - 259 | 0.0 |
| 260 - 279 | 0.0 |
| 280 - 299 | 0.0 |
| > 299 | 0.0 |
| min size (mm) | 52 |
| max size (mm) | 215 |
| mean | 114 |
| mode | 132 |

## Lytechinus anamesus

| | |
|---|---|
| (cases) N= | 108 |
| < 5 | 0.9% |
| 5 - 9 | 5.6% |
| 10 - 14 | 36.1% |
| 15 - 19 | 45.4% |
| 20 - 24 | 11.1% |
| 25 - 29 | 0.0 |
| 30 - 34 | 0.9% |
| 35 - 39 | 0.0 |
| > 39 | 0.0 |
| min size (mm) | 4 |
| max size (mm) | 33 |
| mean | 15 |
| mode | 17 |

## Parastichopus parvimensis

| | |
|---|---|
| (cases) N= | 31 |
| < 5 | 0.0 |
| 5 - 6 | 6.5% |
| 7 - 8 | 9.7% |
| 9 - 10 | 12.9% |
| 11 - 12 | 41.9% |
| 13 - 14 | 16.1% |
| 15 - 16 | 12.9% |
| > 16 | 0.0 |
| min size (cm) | 6 |
| max size (cm) | 15 |
| mean | 11 |
| mode | 11 |

## Strongylocentrotus franciscanus

| | |
|---|---|
| (cases) N= | 165 |
| < 5 | 0.0 |
| 5 - 9 | 0.6% |
| 10 - 14 | 0.6% |
| 15 - 19 | 0.6% |
| 20 - 24 | 6.7% |

| | |
|---|---|
| 25 - 29 | 7.9% |
| 30 - 34 | 5.5% |
| 35 - 39 | 6.1% |
| 40 - 44 | 10.3% |
| 45 - 49 | 6.7% |
| 50 - 54 | 12.1% |
| 55 - 59 | 9.7% |
| 60 - 64 | 9.7% |
| 65 - 69 | 8.5% |
| 70 - 74 | 3.0% |
| 75 - 79 | 4.8% |
| 80 - 84 | 3.0% |
| 85 - 90 | 0.6% |
| 90 - 94 | 1.2% |
| 95 - 99 | 1.2% |
| 100 - 104 | 1.2% |
| 105 - 109 | 0.0 |
| > 109 | 0.0 |
| min size (mm) | 6 |
| max size (mm) | 101 |
| mean | 51 |
| mode | 42 |

Macrocystis pyrifera numbers of stipes.

| | |
|---|---|
| (cases) N= | 84 |
| < 3 | 45.2% |
| 3 - 5 | 25.0% |
| 6 - 8 | 14.3% |
| 9 - 11 | 3.6% |
| 12 - 14 | 1.2% |
| 15 - 17 | 0.0 |
| 18 - 20 | 1.2% |
| 21 - 23 | 3.6% |
| 24 - 26 | 1.2% |
| 27 - 29 | 3.6% |
| 30 - 32 | 0.0 |
| 33 - 35 | 0.0 |
| 36 - 38 | 0.0 |
| 39 - 41 | 0.0 |
| 42 - 44 | 0.0 |
| >44 | 1.2% |
| min number | 1 |
| max number | 50 |
| mean | 6 |
| mode | 2 |

Strongylocentrotus purpuratus

| | |
|---|---|
| (cases) N= | 159 |
| < 5 | 4.4% |
| 5 - 9 | 8.8% |
| 10 - 14 | 12.6% |
| 15 - 19 | 17.6% |
| 20 - 24 | 25.8% |
| 25 - 29 | 22.0% |
| 30 - 34 | 5.7% |
| 35 - 39 | 1.3% |
| 40 - 44 | 1.3% |
| 45 - 49 | 0.6% |
| 50 - 54 | 0.0 |
| 55 - 59 | 0.0 |
| 60 - 64 | 0.0 |
| 65 - 69 | 0.0 |
| 70 - 74 | 0.0 |
| 75 - 79 | 0.0 |
| 80 - 84 | 0.0 |
| 85 - 90 | 0.0 |
| 90 - 94 | 0.0 |
| 95 - 99 | 0.0 |
| 100 - 104 | 0.0 |
| 105 - 109 | 0.0 |
| > 109 | 0.0 |
| min size (mm) | 2 |
| max size (mm) | 47 |
| mean | 20 |
| mode | 21 |

Macrocystis pyrifera holdfast diameters.

| | |
|---|---|
| (cases) N= | 84 |
| < 6 | 15.5% |
| 6 - 11 | 50.0% |
| 12 - 17 | 14.3% |
| 18 - 23 | 2.4% |
| 24 - 29 | 7.1% |
| 30 - 35 | 6.0% |
| 36 - 41 | 2.4% |
| 42 - 47 | 1.2% |
| 48 - 53 | 0.0 |
| 54 - 59 | 1.2% |
| 60 - 65 | 0.0 |
| 66 - 71 | 0.0 |
| 72 - 77 | 0.0 |
| 78 - 83 | 0.0 |
| 84 - 89 | 0.0 |
| >89 | 0.0 |
| min width (cm) | 3 |
| max width (cm) | 59 |
| mean | 13 |
| mode | 9 |

LOCATION 16 SANTA BARBARA ISLAND - CAT CANYON

1990 QUADRAT DATA: MEAN NUMBER PER $M^2$

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Macrocystis pyrifera adult | 0.0500 | 0.1539 | 20 |
| Eisenia arborea | 0.0000 | 0.0000 | 20 |
| Pterygophora californica | 0.0000 | 0.0000 | 20 |
| Laminaria farlowii | 0.0000 | 0.0000 | 20 |
| Macrocystis pyrifera juvenile | 0.1500 | 0.4894 | 20 |
| Macrocystis pyrifera all | 0.2000 | 0.6366 | 20 |
| Cypraea spadicea | 0.0250 | 0.1118 | 20 |
| Astraea undosa | 0.5000 | 0.7609 | 20 |
| Patiria miniata | 0.0000 | 0.0000 | 20 |
| Pisaster giganteus | 0.1250 | 0.2221 | 20 |
| Strongylocentrotus franciscanus | 2.5500 | 2.1145 | 20 |
| Strongylocentrotus purpuratus | 42.2500 | 18.2313 | 20 |
| Parastichopus parvimensis | 0.4000 | 0.4472 | 20 |
| Styela monteryensis | 0.0000 | 0.0000 | 20 |
| Lythrypnus dalli | 0.0000 | 0.0000 | 20 |
| Coryphopterus nicholsii | 0.2500 | 0.3804 | 20 |
| Alloclinus holderi | 0.9500 | 0.7931 | 20 |

1990 BAND TRANSECT DATA: MEAN NUMBER PER $M^2$

| | | | |
|---|---|---|---|
| Tethya aurantia | 0.0000 | 0.0000 | 12 |
| Allopora californica | 0.0000 | 0.0000 | 12 |
| Tealia lofotensis | 0.0000 | 0.0000 | 12 |
| Lophogorgia chilensis | 0.0000 | 0.0000 | 12 |
| Muricea fruticosa | 0.0000 | 0.0000 | 12 |
| Muricea californica | 0.0000 | 0.0000 | 12 |
| Panulirus interruptus | 0.0111 | 0.0192 | 12 |
| Haliotis rufescens | 0.0000 | 0.0000 | 12 |
| Haliotis corrugata | 0.0042 | 0.0104 | 12 |
| Haliotis fulgens | 0.0000 | 0.0000 | 12 |
| Kelletia kelletii | 0.0000 | 0.0000 | 12 |
| Megathura crenulata | 0.0042 | 0.0075 | 12 |
| Hinnites giganteus | 0.0014 | 0.0048 | 12 |
| Aplysia californica | 0.0611 | 0.0524 | 12 |
| Pycnopodia helianthoides | 0.0000 | 0.0000 | 12 |
| Lytechinus anamesus | 0.0000 | 0.0000 | 12 |

LOCATION 16 SANTA BARBARA ISLAND - CAT CANYON
1990 RANDOM POINT CONTACT DATA: MEAN PERCENT COVER

| Species | MEAN | STD DEV | CASES |
|---|---|---|---|
| Green algae | 0.9000 | 1.8930 | 25 |
| Miscellaneous brown algae | 0.8000 | 2.2500 | 25 |
| Desmarestia spp. | 0.0000 | 0.0000 | 25 |
| Laminaria farlowii | 0.0000 | 0.0000 | 25 |
| Cystoseira spp. | 0.4000 | 1.1815 | 25 |
| Macrocystis, Eisenia, Pterygophora | 3.3000 | 9.8879 | 25 |
| Miscellaneous red algae | 10.0000 | 7.4652 | 25 |
| Articulated coralline algae | 7.9000 | 9.8340 | 25 |
| Crustose coralline algae | 29.8000 | 15.0852 | 25 |
| Gelidium spp. | 0.1000 | 0.5000 | 25 |
| Gigartina spp. | 0.0000 | 0.0000 | 25 |
| Miscellaneous plants | 1.0000 | 4.0182 | 25 |
| Sponges | 0.6000 | 1.3070 | 25 |
| Corynactis californica | 0.0000 | 0.0000 | 25 |
| Balanophyllia elegans | 2.4000 | 3.4970 | 25 |
| Astrangia lajollaensis | 0.9000 | 1.5943 | 25 |
| Diopatra ornata | 0.2000 | 0.6922 | 25 |
| Phragmatopoma californica | 8.1000 | 5.1680 | 25 |
| Serpulorbis squamigerus | 2.7000 | 2.9686 | 25 |
| Bryozoans, other | 2.5000 | 6.7315 | 25 |
| Diaperoecia californica | 0.6000 | 2.1985 | 25 |
| Tunicates | 2.4000 | 3.6429 | 25 |
| Miscellaneous invertebrates | 17.5000 | 8.1650 | 25 |
| Bare substrate | 33.0000 | 10.7287 | 25 |
| Rock | 89.7000 | 13.1719 | 25 |
| Cobble | 1.3000 | 3.2372 | 25 |
| Sand | 9.0000 | 10.3330 | 25 |

1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| | | | |
|---|---|---|---|
| TOTAL FISH ABUNDANCE | 7.8681 | 29.0216 | 144 |
| Chromis punctipinnis | 76.4167 | 72.1910 | 12 |
| Oxyjulis californica | 8.2500 | 7.9100 | 12 |
| Sebastes mystinus | 0.0000 | 0.0000 | 12 |
| Sebastes serranoides | 0.0000 | 0.0000 | 12 |
| Sebastes atrovirens | 0.0000 | 0.0000 | 12 |
| Paralabrax clathratus | 1.7500 | 1.2154 | 12 |
| Semicossyphus pulcher | 1.8333 | 1.0299 | 12 |
| Embiotoca jacksoni | 0.2500 | 0.4523 | 12 |
| Embiotoca lateralis | 0.0000 | 0.0000 | 12 |
| Damalichthys vacca | 0.0000 | 0.0000 | 12 |
| Hypsypops rubicundus | 2.5000 | 1.3143 | 12 |
| Girella nigricans | 3.4167 | 3.1467 | 12 |

LOCATION 16 SANTA BARBARA ISLAND - CAT CANYON
1990 FISH TRANSECT DATA: MEAN NUMBER PER TRANSECT

| Species | Date (year/month/day) | Mean | Std Dev | Cases |
|---|---|---|---|---|
| Chromis punctipinnis adult | | 35.0000 | 17.0507 | 12 |
| | 900620 | 48.5000 | 8.5829 | 4 |
| | 900823 | 28.2500 | 16.4034 | 8 |
| Chromis punctipinnis juvenile | | 41.4167 | 71.0729 | 12 |
| | 900620 | 0.0000 | 0.0000 | 4 |
| | 900823 | 62.1250 | 80.4211 | 8 |
| Oxyjulis californica adult | | 8.2500 | 7.9100 | 12 |
| | 900620 | 10.5000 | 11.7898 | 4 |
| | 900823 | 7.1250 | 5.8661 | 8 |
| Oxyjulis californica juvenile | | 0.0000 | 0.0000 | 12 |
| | 900620 | 0.0000 | 0.0000 | 4 |
| | 900823 | 0.0000 | 0.0000 | 8 |
| Sebastes mystinus adult | | 0.0000 | 0.0000 | 12 |
| | 900620 | 0.0000 | 0.0000 | 4 |
| | 900823 | 0.0000 | 0.0000 | 8 |
| Sebastes mystinus juvenile | | 0.0000 | 0.0000 | 12 |
| | 900620 | 0.0000 | 0.0000 | 4 |
| | 900823 | 0.0000 | 0.0000 | 8 |
| Sebastes serranoides adult | | 0.0000 | 0.0000 | 12 |
| | 900620 | 0.0000 | 0.0000 | 4 |
| | 900823 | 0.0000 | 0.0000 | 8 |

| | | | |
|---|---|---|---|
| Sebastes serranoides juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900620 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900823 | 0.0000 | 0.0000 |
| 8 | | | |
| Sebastes atrovirens adult | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900620 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900823 | 0.0000 | 0.0000 |
| 8 | | | |
| Sebastes atrovirens juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900620 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900823 | 0.0000 | 0.0000 |
| 8 | | | |
| Paralabrax clathratus adult | | 1.5000 | 1.3143 |
| 12 | | | |
| | 900620 | 0.5000 | 0.5774 |
| 4 | | | |
| | 900823 | 2.0000 | 1.3093 |
| 8 | | | |

| | | | |
|---|---|---|---|
| Paralabrax clathratus juvenile | | 0.2500 | 0.6216 |
| 12 | | | |
| | 900620 | 0.7500 | 0.9574 |
| 4 | | | |
| | 900823 | 0.0000 | 0.0000 |
| 8 | | | |
| Semicossyphus pulcher male | | 0.0833 | 0.2887 |
| 12 | | | |
| | 900620 | 0.2500 | 0.5000 |
| 4 | | | |
| | 900823 | 0.0000 | 0.0000 |
| 8 | | | |
| Semicossyphus pulcher female | | 1.7500 | 1.1382 |
| 12 | | | |
| | 900620 | 1.2500 | 1.2583 |
| 4 | | | |
| | 900823 | 2.0000 | 1.0690 |
| 8 | | | |
| Embiotoca jacksoni adult | | 0.2500 | 0.4523 |
| 12 | | | |
| | 900620 | 0.7500 | 0.5000 |
| 4 | | | |
| | 900823 | 0.0000 | 0.0000 |
| 8 | | | |
| Embiotoca jacksoni juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900620 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900823 | 0.0000 | 0.0000 |
| 8 | | | |
| Embiotoca lateralis adult | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900620 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900823 | 0.0000 | 0.0000 |
| 8 | | | |
| Embiotoca lateralis juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900620 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900823 | 0.0000 | 0.0000 |
| 8 | | | |
| Damalichthys vacca adult | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900620 | 0.0000 | 0.0000 |
| 4 | | | |

| | | | |
|---|---|---|---|
| | 900823 | 0.0000 | 0.0000 |
| 8 | | | |
| Damalichthys vacca juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900620 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900823 | 0.0000 | 0.0000 |
| 8 | | | |
| Hypsypops rubicundus adult | | 2.5000 | 1.3143 |
| 12 | | | |
| | 900620 | 3.5000 | 1.0000 |
| 4 | | | |
| | 900823 | 2.0000 | 1.1952 |
| 8 | | | |
| Hypsypops rubicundus juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900620 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900823 | 0.0000 | 0.0000 |
| 8 | | | |
| Girella nigricans adult | | 3.4167 | 3.1467 |
| 12 | | | |
| | 900620 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900823 | 5.1250 | 2.3566 |
| 8 | | | |
| Girella nigricans juvenile | | 0.0000 | 0.0000 |
| 12 | | | |
| | 900620 | 0.0000 | 0.0000 |
| 4 | | | |
| | 900823 | 0.0000 | 0.0000 |
| 8 | | | |

# LOCATION 16 SANTA BARBARA ISLAND - CAT CANYON
# 1990 SIZE FREQUENCY DISTRIBUTIONS

## Haliotis corrugata

| | |
|---|---|
| (cases) N= | 15 |
| < 95 | 0.0 |
| 95 - 99 | 0.0 |
| 100 - 104 | 0.0 |
| 105 - 109 | 0.0 |
| 110 - 114 | 6.7% |
| 115 - 119 | 13.3% |
| 120 - 124 | 13.3% |
| 125 - 129 | 6.7% |
| 130 - 134 | 13.3% |
| 135 - 139 | 6.7% |
| 140 - 144 | 13.3% |
| 145 - 149 | 6.7% |
| 150 - 154 | 0.0 |
| 155 - 159 | 0.0 |
| 160 - 164 | 0.0 |
| 165 - 169 | 6.7% |
| 170 - 174 | 6.7% |
| 175 - 179 | 6.7% |
| 180 - 184 | 0.0 |
| 185 - 189 | 0.0 |
| 190 - 194 | 0.0 |
| 195 - 199 | 0.0 |
| > 199 | 0.0 |
| min size (mm) | 110 |
| max size (mm) | 178 |
| mean | 138 |
| mode | 122 |

## Parastichopus parvimensis

| | |
|---|---|
| (cases) N= | 53 |
| < 5 | 0.0 |
| 5 - 6 | 0.0 |
| 7 - 8 | 9.4% |
| 9 - 10 | 32.1% |
| 11 - 12 | 28.3% |
| 13 - 14 | 28.3% |
| 15 - 16 | 1.9% |
| 17 - 18 | 0.0 |
| 19 - 20 | 0.0 |
| 21 - 22 | 0.0 |
| > 22 | 0.0 |
| min size (cm) | 7 |
| max size (cm) | 15 |
| mean | 11 |
| mode | 13 |

## Astraea undosa

| | |
|---|---|
| (cases) N= | 51 |
| < 10 | 0.0 |
| 10 - 19 | 0.0 |
| 20 - 29 | 0.0 |
| 30 - 39 | 0.0 |
| 40 - 49 | 0.0 |
| 50 - 59 | 23.5% |
| 60 - 69 | 60.8% |
| 70 - 79 | 15.7% |
| 80 - 89 | 0.0 |
| 90 - 99 | 0.0 |
| 100 - 109 | 0.0 |
| 110 - 119 | 0.0 |
| > 119 | 0.0 |
| min size (mm) | 50 |
| max size (mm) | 76 |
| mean | 63 |
| mode | 65 |

## Pisaster giganteus

| | |
|---|---|
| (cases) N= | 49 |
| < 20 | 0.0 |
| 20 - 39 | 0.0 |
| 40 - 59 | 0.0 |
| 60 - 79 | 8.2% |
| 80 - 99 | 30.6% |
| 100 - 119 | 51.0% |
| 120 - 139 | 6.1% |
| 140 - 159 | 4.1% |
| 160 - 179 | 0.0 |
| 180 - 199 | 0.0 |
| 200 - 219 | 0.0 |
| 220 - 239 | 0.0 |
| 240 - 259 | 0.0 |
| 260 - 279 | 0.0 |
| 280 - 299 | 0.0 |
| > 299 | 0.0 |
| min size (mm) | 71 |
| max size (mm) | 151 |
| mean | 104 |
| mode | 119 |

Strongylocentrotus franciscanus

| | |
|---|---|
| (cases) N= | 100 |
| < 5 | 0.0 |
| 5 - 9 | 0.0 |
| 10 - 14 | 0.0 |
| 15 - 19 | 0.0 |
| 20 - 24 | 0.0 |
| 25 - 29 | 0.0 |
| 30 - 34 | 5.0% |
| 35 - 39 | 7.0% |
| 40 - 44 | 15.0% |
| 45 - 49 | 10.0% |
| 50 - 54 | 11.0% |
| 55 - 59 | 5.0% |
| 60 - 64 | 7.0% |
| 65 - 69 | 11.0% |
| 70 - 74 | 8.0% |
| 75 - 79 | 7.0% |
| 80 - 84 | 7.0% |
| 85 - 90 | 2.0% |
| 90 - 94 | 3.0% |
| 95 - 99 | 0.0 |
| 100 - 104 | 1.0% |
| 105 - 109 | 0.0 |
| > 109 | 1.0% |
| min size (mm) | 32 |
| max size (mm) | 123 |
| mean | 59 |
| mode | 40 |

Strongylocentrotus purpuratus

| | |
|---|---|
| (cases) N= | 104 |
| < 5 | 0.0 |
| 5 - 9 | 0.0 |
| 10 - 14 | 0.0 |
| 15 - 19 | 0.0 |
| 20 - 24 | 1.0% |
| 25 - 29 | 30.8% |
| 30 - 34 | 35.6% |
| 35 - 39 | 20.2% |
| 40 - 44 | 5.8% |
| 45 - 49 | 6.7% |
| 50 - 54 | 0.0 |
| 55 - 59 | 0.0 |
| 60 - 64 | 0.0 |
| 65 - 69 | 0.0 |
| 70 - 74 | 0.0 |
| 75 - 79 | 0.0 |
| 80 - 84 | 0.0 |
| 85 - 90 | 0.0 |
| 90 - 94 | 0.0 |
| 95 - 99 | 0.0 |
| 100 - 104 | 0.0 |
| 105 - 109 | 0.0 |
| > 109 | 0.0 |
| min size (mm) | 21 |
| max size (mm) | 49 |
| mean | 33 |
| mode | 27 |

Macrocystis pyrifera numbers of stipes.

| | |
|---|---|
| (cases) N= | 99 |
| < 3 | 15.2% |
| 3 - 5 | 13.1% |
| 6 - 8 | 10.1% |
| 9 - 11 | 9.1% |
| 12 - 14 | 16.2% |
| 15 - 17 | 12.1% |
| 18 - 20 | 9.1% |
| 21 - 23 | 6.1% |
| 24 - 26 | 5.1% |
| 27 - 29 | 1.0% |
| 30 - 32 | 2.0% |
| 33 - 35 | 1.0% |
| 36 - 38 | 0.0 |
| 39 - 41 | 0.0 |
| 42 - 44 | 0.0 |
| >44 | 0.0 |
| min number | 1 |
| max number | 34 |
| mean | 12 |
| mode | 1 |

Macrocystis pyrifera holdfast diameters.

| | |
|---|---|
| (cases) N= | 99 |
| < 6 | 8.1% |
| 6 - 11 | 11.1% |
| 12 - 17 | 4.0% |
| 18 - 23 | 3.0% |
| 24 - 29 | 15.2% |
| 30 - 35 | 19.2% |
| 36 - 41 | 20.2% |
| 42 - 47 | 11.1% |
| 48 - 53 | 6.1% |
| 54 - 59 | 1.0% |
| 60 - 65 | 1.0% |
| 66 - 71 | 0.0 |
| 72 - 77 | 0.0 |
| 78 - 83 | 0.0 |
| 84 - 89 | 0.0 |
| >89 | 0.0 |
| min width (cm) | 2 |
| max width (cm) | 65 |
| mean | 30 |
| mode | 24 |

**Appendix B.** 1990 Species List for all Channel Islands National Park Kelp Forest Monitoring Stations.

Introduction .

The species list contains presence/absence and relative abundance data for all species that could be found during the site visits between June and October. Generally at least one dive is made by an experienced biologist strictly for species list observations. The overall effort varies from station to station with the water conditions and available time. Relative abundance values are subjective, and generally based on opinions of several divers viewing the overall site. Some species assemblages are more difficult to identify than others and may be lumped into general categories. Organisms were generally not collected for additional taxonomic work. When identification is tentative we either do not mark it or place a question mark on the list. Some categories, (eg. sponges or tunicates) may be much more diverse than it would appear from the list.

Abundance Ratings

- X - present, no relative abundance rating given
- 4 - abundant, organism present in higher than normal densities
- 3 - common, organism found over most of site or in high density patches
- 2 - present, organism found in moderate numbers
- 1 - rare, few organisms found
- 0 - noticeably absent, an effort was made to look for an organism that was not found.

Notes

- e - eggs
- j or jvs - juvenile
- s - shell only
- int - intertidal
- d - drift
- PM or night - seen only on night dive
- JX - juveniles present and adults present
- J#/# - (e.g. J3/2 - juvenile abundance 3, adult abundance 2)
- nests - hypsypops nest turf
- dis - diseased

Station names are listed in Table 3 of the text.